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THE LEHIGH UNIVERSITY,

1892-1893

SOUTH BETHLEHEM, PA.
1892.

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OF

THE LEHIGH UNIVERSITY,

SOUTH BETHLEHEM, PA.

1892-1893.

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BETHLEHEM, PA.:
TIMES PUBLISHING COMPANY.
1892.

TABULAR ALMANAC.

1892.

JULY.

S	M	T	W	T	F	S
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SEPTEMBER.

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1893.

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1894.

JANUARY.

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JUNE.

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CALENDAR.

1892.	1892-1893.	
Sept. 10, 12, 13,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 14,	Wednesday, . .	First Term begins.
Oct. 13,	Thursday, . .	Founder's Day.
Nov. 24,	Thursday, . .	Thanksgiving Day.
Dec. 21,	Wednesday, .	First Term ends.
1893.		
Jan. 10, 11,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 11,	Wednesday, .	Second Term begins.
Jan. 21,	Saturday, . .	Junior Prize Orations due.
Feb. 15,	Wednesday, .	Ash Wednesday.
Feb. 22,	Wednesday, . .	Washington's Birthday.
March 30,	Thursday, . .	Easter Holidays begin.
April 4,	Tuesday, . .	Easter Holidays end at $8\frac{1}{4}$ A.M.
May 29,	Monday, . .	University Day Orations due.
May 31,	Wednesday, . .	Theses of Seniors due.
May 31,	Wednesday, .	Senior Examinations begin.
June 12,	Monday, . . .	Annual Examinations begin.
June 18,	Sunday, . .	Baccalaureate Sermon.
June 19,	Monday, . . .	Class Day.
June 21,	Wednesday, .	University Day.
Jun. 22, 23, 24,	Thursday, Friday, and Saturday,	Examinations for Admission.
1893.	**1893-1894.**	
Sept. 9, 11, 12,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 13,	Wednesday, . .	First Term begins.
Oct. 12,	Thursday, . .	Founder's Day.
Nov. 30,	Thursday, . .	Thanksgiving Day.
Dec. 20,	Wednesday, .	First Term ends.
1894.		
Jan. 9, 10,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 10,	Wednesday, . .	Second Term begins.
June 20,	Wednesday, .	University Day.

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*ThomasHarrisonSymington,	M.E.,	Baltimore, Md.
*John Taylor, jr.,	A.C.,	Bethlehem.
Lewis Esler Troutman,	E.E.,	Pottsville.
Fred Conover Warman,	C.E.,	Washington, D. C.

JUNIOR CLASS.

	Course.	Residence.
William A. Allgaier,	E.M.,	Philadelphia.
William Conklin Anderson,	E.E.,	New York City.
Geo. Washington Scott Baton,	E.M.,	Philadelphia.
Irvin Isaac Beinhower,	M.E.,	Steelton.
Thomas Joseph Bray, jr.,	M.E.,	Warren, O.
Lawrence Calvin Brink,	C.E.,	Trenton, N. J.
Rezeau Blanchard Brown,	M.E.,	Somerville, N. J.
Emott Davis Buel,	C.E..	Cumberland, Md.
James Lindsey Burley,	C.E.,	Moundsville, W. Va.
Ellis Buchanan Byllesby,	A.C.,	Allegheny.
William Colwell Carnell,	A.C.,	Philadelphia.
*Morris Llewellyn Cooke,	M.E.,	South Bethlehem.
*Benjamin F. Cresson, jr.,	C.E.,	Conshohocken.
Walter Jules Douglas,	C.E.,	Washington, D. C.
Walter Sewell Dunscomb,	C.E.,	Brooklyn, N. Y.

* Not clear of conditions.

	Course.	Residence.
Thaddeus Percival Elmore,	C E.,	Elmira, N. Y.
*Theodore Gwathmey Empie,	E. E.,	Wilmington, N. C.
*Benjamin Franklin Faust,	E. E.,	Berwick.
James Dubose Ferguson,	C. E.,	Washington, D. C.
Robert Ferriday,	C. E.,	South Bethlehem.
*Richard Daniel Floyd,	A. C.,	Milton, Mass.
John Jacob Frank,	E. E.,	Columbia.
Luther L. Gadd,	E. E.,	Sudlersville, Md.
Frank Wieseman Glading,	M. E.,	Philadelphia.
*Milton Brayton Graff,	A. C.,	Glendale, O.
Elwood Aristides Grissinger,	E. E.,	Mechanicsburg.
Bayard Guthrie,	M. E.,	Fort Sill, Indian Ty.
William McCleery Hall,	C. E.,	Lancaster.
Fletcher Dickerman Hallock,	E. E.,	Plainfield, N. J.
Robert Rieman Harvey,	E. E.,	Wilkes-Barre.
Arthur Williston Henshaw,	E. E.,	Amherst, Mass.
Anton Yost Hesse,	C. E.,	Bethlehem.
Foster Haven Hilliard,	C. E.,	Sparrow's Point, Md.
Bayly Hipkins,	C. E.,	Oakland, Md.
Matthias Harry Holz,	M. E.,	Philadelphia.
Alfred A. Howitz,	M. E.,	West Pittston.
*James Edward Hughes,	Clas.,	Philadelphia.
Geo. Washington Hunsicker,	A. C.,	Allentown.
George Cass Hutchinson,	M. E.,	Sewickley.
*Charles Borrows Jacobs,	E. M.,	South Bethlehem.
Victor Albert Johnson,	E. M.,	St. Paul, Minn.
Arthur Bacon Jones,	A. C.,	Sewickley.
Barry Holme Jones,	E. M.,	Bethlehem.
Wm. Harrison Kavanaugh,	M. E.,	Williamsport.
Richard Warren Knight,	C. E.,	Camden, N. J.
*Louis John Krom,	A. C.,	Plainfield, N. J.
Claude Averett Langdon,	C. E.,	Chambersburg.
James Edwin Little,	M. E.,	Hokendauqua.
Clarence Oliver Luckenbach,	M. E.,	Bethlehem.
Matthew McClung, jr.,	E. M.,	Knoxville, Tenn.
John D. McPherson, jr.,	E. E.,	Washington, D.C.

* Not clear of conditions.

	Course.	Residence.
John Vansickle Martenis,	M.E.,	South Bethlehem.
*Walter Henry Miller,	M.E.,	Osage City, Kan.
Charles Asher Moore,	E.E.,	Hammonton, N. J.
Julius Lederer Neufeld,	E.E.,	Philadelphia.
Carl Wm. Frederick Neuffer,	C.E.,	Scranton.
Charles Atwood Newbaker,	E.E.,	Danville.
Richard Leslie Ogden,	A.C.,	Shenandoah.
Godwin Ordway,	E.M.,	Washington, D.C.
*Jeremiah Francis O'Hearn,	C.E.,	Shenandoah.
Edward Boteler Passano,	M.E.,	Baltimore, Md.
William Arthur Payne,	Arch.,	Brooklyn, N. Y.
Benjamin Rush Petrikin,	E.E.,	Lock Haven.
*William Vaughan Pettit, jr.,	E.M.,	Philadelphia.
*William Miller Purman,	E.E.,	Washington, D. C.
*Samuel Neely Riter,	M.E.,	Pittsburgh.
Thomas Charles Roderick,	E.E.,	Canal Dover, O.
Frank William Roller,	M.E.,	New York City.
Charles Beecher Rutter,	E.M.,	Lansford.
*Clement Clarence Rutter,	C.E.,	Lansford.
Herman Schneider,	Arch.,	Summit Hill.
Benj. Ferdinand Schomberg,	M.E.,	Altoona.
Eugene Schwinghammer,	E.E.,	Washington, D. C.
Edgar Earnest Seyfert,	C.E.,	Pine Grove.
George Elwood Shepherd,	E.E.,	Wilkes-Barre.
Charles Elder Shipley,	E.E.,	Baltimore, Md.
Robert Eugene Smith,	M.E.,	West Bethlehem.
Charles Smithers,	E.E.,	New York City.
*Herbert Ridley Stratford,	A.C.,	Jersey City, N. J.
Walter Christian Swartz,	M.E.,	Allentown.
Frederick George Sykes,	E.E.,	Apponang, R. I.
*CharlesHamiltonThompson,	E.M.,	Berryville, Va.
Philip Henry Trout, jr.,	E.E.,	Staunton, Va.
*Orson William Trueworthy,	M.E.,	Washington, D. C.
Clarence Porter Turner,	E.E.,	Wilkes-Barre.
Charles W. Underwood,	E.E.,	Mechanicsburg.
Jacob von Maur,	C.E.,	West Pittston.

* Not clear of conditions.

	Course.	Residence.
Alonzo Leach Ware,	C.E.,	Ocean City, N. J.
Edward Olmstead Warner,	E.E.,	Salisbury, Conn.
Ruel Chaffee Warriner,	E.M.,	Montrose.
*Howard Perry Weir,	M.E.,	New York City.
Aubrey Weymouth,	C.E.,	Richmond, Va.
Thomas William Wilson,	C.E.,	Harrisburg.
Weldon Burris Wooden,	C.E.,	Hampstead, Md.
*Charles Rush Yerrick,	M.E.,	Danville.

SOPHOMORE CLASS.

	Course.	Residence.
Herman Leon Arbenz,	C.E.,	Wheeling, W. Va.
Chester Terrill Ayres,	E.E.,	Williamsport.
Franklin Baker, jr.,	E.M.,	Philadelphia.
Clarence Kemble Baldwin,	M.E.,	Philadelphia.
Anthony Francis Bannon, jr.,	C.E.,	Bradford.
John Collinson Barber,	C.E.,	Conaways, Md.
William Maclay Bard,	E.E.,	Washington, D. C.
Robert Josiah Bartholomew,	M.E.,	Bath.
Rollin Calvert Bastress,	C.E.,	Sunbury.
Harry Wilber Beach,	M.E.,	Montrose.
George Beggs, jr.,	C.E.,	Reading.
John Henry Best,	C.E.,	Mechanicsburg.
Haldeman Bigler,	A.C.,	Harrisburg.
*Ernest Mar Blehl,	E.E.,	Philadelphia.
Charles Sumner Bricker,	M.E.,	Lititz.
James Emery Brooks,	M.E.,	East Orange, N. J.
Eugene Clare Brown,	E.E.,	Washington, D. C.
William Henry Brown,	E.M.,	Yatesville.
Walter Turpin Brown,	C.E.,	Centreville, Md.
James Hodgson Budd,	C.E.,	Lebanon.
Charles Calvin Burgess,	C.E.,	Flemington, N. J.
*John Thomas Callaghan, jr.,	E.M.,	Washington, D. C.
†Robert Edes Chetwood, jr.,	E.E.,	Elizabeth, N. J.
Francis Lee Castleman,	C.E.,	Gaylord, Va.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Edward Bailey Clark,	M.E.,	Columbia, S. C.
Norman Frederic Clark,	E.E.,	Philadelphia.
Arthur Stebbins Clift,	M.E.,	Croton Falls, N. Y.
Edward Perrine Cody,	C.E.,	Philadelphia.
William Wheeler Coleman,	E.M.,	Baltimore, Md.
William J. Collier,	C.E.,	Duncannon.
Herbert Maurice Crawford,	C.E.,	Manorville.
Henry M. S. Cressman,	Clas.,	Sellersville.
Robert Adriance Davidson,	E.E.,	Northport, L. I.
*Paul Benjamin Davis,	A.C.,	Reading.
Howard Stephen Dech,	M.E.,	Bethlehem.
Henry De Huff,	E.E.,	Lebanon.
Stanley Chipman de Witt,	E.E.,	Halifax, N. S.
James Nelson Dezendorf,	M.E.,	Norfolk, Va.
James Chambers Dick,	C.E.,	Brockwayville.
Benjamin Irvin Drake,	E.M.,	South Bethlehem.
†Beekman DuBarry, jr.,	M.E.,	Washington, D. C.
Lewis Stokes Duling,	C.E.,	Philadelphia.
Howard Eckfeldt,	E.M.,	Conshohocken.
Alfred Wm. Alexander Eden,	C.E.,	Brown's Town, Jamai-
Stephen Elliott,	A.C.,	Beaufort, S. C. [ca.
Edward L. Faison, jr.,	C.E.,	Elliott, N. C.
Guy Hector Farman,	E.M.,	Westfield, Vt.
Edward Calvin Ferriday,	Clas.,	South Bethlehem.
Walter Ferris,	M.E.,	Jennersville.
Curtis Bertram Flory,	E.E.,	Scranton.
Clarence Richard Fountain,	E.E.,	Good Hope, D.C.
George Lane Gabrio,	E.E.,	Hazleton.
Andres Garza Galàn,	C.E.,	Saltillo, Mex.
Andrew Gallagher,	E.E.,	South Bethlehem.
Eduardo Antonio Giberga,	M.E.,	Matanzas, Cuba.
John Jameson Gibson,	E.E.,	York.
Elmer Grant Godshalk,	A.C.,	Lansdale.
*John Edgar Gomery,	C.E.,	Lehighton.
Wallace Russell Goss,	C.E.,	Union, S. C.
William Heald Groverman,	M.E.,	Oakland, Md.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Frederick Taylor Haines,	C.E.,	Elkton, Md.
Thomas Graham Hamilton,	E.E.,	Pittsburgh.
Robert Graham Hengst,	E.E.,	Pittsburgh.
Thomas Lloyd Henry,	C.E.,	Troy, N. Y.
Howard Samuel Hess,	Clas.,	Hellertown.
†Ira Miller Higbee,	C.E.,	Watsontown.
*Arthur Seward Holman,	E.E.,	Kansas City, Mo.
William Hopkins,	E.E.,	Washington, D.C.
*Edgar Alonzo Houston,	C.E.,	Bellvale, N. Y.
*Robert Selden Huse,	E.M.,	Highland Falls, N. Y.
William Thomas Hutchins,	C.E.,	Wyoming.
Drew William Irvine,	E.E.,	Columbia, Tenn.
Elmer Augustus Jacoby,	Clas.,	Locust Valley.
William Agassiz James,	E.M.,	Wilkes-Barre.
†Henry Scudder Jaudon,	C.E.,	Savannah, Ga.
Albert Beardsley Jessup,	E.E.,	Scranton.
Elisha Barton John,	C.E.,	Bloomsburg.
Henry Harrison Jones,	C.E.,	Reading.
Adolph Somers Kappella,	E.E.,	Philadelphia.
Dixon Kautz,	L.S.,	Moweaqua, Ill.
Warren Byron Keim,	C.E.,	Reading.
Leroy Allen Kendall,	M.E.,	Buffalo, N. Y.
†Henry Edward Kip,	Arch.,	Buffalo, N. Y.
David Henshey Lackey,	E.E.,	Altoona.
William Allen Lambert,	Clas.,	Hellertown.
Louis Edgar Lannan,	E.E.,	Washington, D. C.
Robert Pierce Lentz,	M.E.,	Lehighton.
Arthur Hughes Lewis,	E.M.,	Plains.
*Gerald Lewis,	A.C.,	Milford.
VanLear Lippitt,	M.E.,	Charlestown.
Benjamin W. Loeb,	A.C.,	Reading.
†Philip Theodore Lovering,	E.E.,	Minneapolis, Minn.
*Gerald Arthur Lowe,	E.E.,	New York City.
*Burt Melville McDonald,	C.E.,	Springfield, Mass.
*Matthew McHugh,	A.C.,	South Bethlehem.
Robert A. McKee,	M.E.,	Towanda.

*Not clear of conditions.
†Excused.

	Course.	Residence.
Fayette Avery McKenzie,	Sci.,	Montrose.
Stuart Tuttle McKenzie,	C.E.,	Montrose.
Norman Peach Massey,	C.E.,	Chestertown, Md.
*George Franklyn Matteson,	M.E.,	Allentown.
Charles Frazier Maurice,	C.E.,	Athens.
William Spencer Merrill,	Clas.,	Newport, Ky.
William Alfred Merritt,	M.E.,	Baltimore, Md.
George Roberts Michener,	E.M.,	Doylestown.
John Samuel Miller,	M.E.,	Harrisburg.
Arthur Elias Morgan,	C.E.,	Wilkes-Barre.
Archibald D. Morris,	M.E.,	Bristol.
Eugene Mowlds,	C.E.,	West Conshohocken.
William Spencer Murray,	E.E.,	Annapolis, Md.
*Harvey Frankenfield Nase,	C.E.,	Springtown.
Robert Neilson, jr.,	C.E.,	Williamsport.
Ira Anthony Oberly,	E.E.,	Bethlehem.
Walter R. Okeson,	C.E.,	Bethlehem.
*Eugene Henry Olds,	M.E.,	Ft. Wayne, Ind.
Charles B. Pennell,	M.E.,	Duncannon.
*Jacob Grafius Petrikin,	Arch.,	Lock Haven.
James Henry Philips,	C.E.,	Atglen.
*Joseph Philips, jr.,	E.M.,	Nashville, Tenn.
†Wilbur Orton Polhemus,	C.E.,	Valley Cottage, N.Y.
John Livingston Poultney,	M.E.,	Baltimore, Md.
*Edward Christopher Price,	A.C.,	Centreville, Md.
Henry Crider Quigley,	E.E.,	Harrisburg.
Homer Austin Reid,	C.E.,	Warren, O.
William Reinecke, jr.,	E.E.,	Louisville, Ky.
Eugene Jesse Rights,	C.E.,	Tahlequah, Ind. Ty.
Herbert Timothy Rights,	C.E.,	Tahlequah, Ind. Ty.
*Antonio M. Ros y Jané,	M.E.,	Guantanamo, Cuba.
*George Homer Ruggles,	C.E.,	Cherokee, Iowa.
†Edmund Monroe Sawtelle,	E.E.,	Philadelphia.
Enrique A. Schumann,	E.M.,	Santiago de Cuba.
Harry Kent Seltzer,	C.E.,	Ephrata.
John Egbert Shero,	A.C.,	Fredonia, N. Y.

* Not clear of conditions.
† Excused.

	Course.	Residence.
*Luther D. Showalter,	C.E.,	Pottstown.
*Robert S. Siegel,	Clas.,	Bethlehem.
†Edwin Harrison Sigison,	E.E.,	Buffalo, N.Y.
John Blake Slack,	E.E.,	Paducah, Ky.
†Richard Andrew Lee Snyder,	E.E.,	Carlisle.
Edward George Steinmetz,	E.E.,	Philadelphia.
John Eugene Stocker,	Sci.,	Bethlehem.
Robert Sayre Taylor,	Sci.,	Bethlehem.
Walter Allison Thacher,	C.E.,	Moorestown, N. J.
*Nathaniel Thurlow,	A.C.,	Lancaster.
Charles Frederick Townsend,	Arch.,	Willimantic, Conn.
Joseph Boyer Townsend,	E.E.,	Venetia.
Fritz John Van Benthem van den Bergh,	C.E.,	Lyndon, Kan.
George Brinton Van Brunt,	C.E.,	Long Branch, N. J.
Willard Randolph Van Liew,	E.M.,	Neshanic, N. J.
Everett Pike Van Mater,	M.E.,	Washington, D. C.
Geo. Brinkerhoff Van Riper,	A.C.,	Rutherford, N. J.
Charles Henry Vansant,	C.E.,	Eddington.
William Warr,	E.E.,	Philadelphia.
Henry Dallam Webster,	M.E.,	Baltimore, Md.
*John Eugene Weideman,	E.E.,	Washington, D. C.
Fred. Irving Wheeler,	C.E.,	Pawtucket, R. I.
William Gwilym Whildin,	E.M.,	Lansford.
Harry Amasa White,	E.E.,	Philadelphia.
John Crum Whitmoyer,	E.E.,	Harrisburg.
Edward Newton Wigfall,	A.C.,	Philadelphia.
John Marion Wilson,	C.E.,	Hillsborough, Md.
Harold L. Wood,	A.C.,	Upper Montclair, N.J.
Hubert Harris Wright,	E.E.,	Cambridge, Md.
Carlos Yglesias,	E.M.,	San José, Costa Rica.
Frank S. Young,	E.M.,	Plymouth Meeting.
Harry Bernard Zimmele,	A.C.,	Bethlehem.

* Not clear of conditions.
† Excused.

FRESHMEN.

	Course.	Residence.
William James Adams,	E.E.,	Harrisburg.
†Samuel Orland Alcott,	E.E.,	Mt. Holly.
Juan de Dios Amador,	M.E.,	Panama, U. S. Col.
William Stewart Ayars,	M.E.,	Wilkes-Barre.
Hobart Bentley Ayers,	M.E.,	Westerly, R. I.
Albert Doane Ayres,	C.E.,	Williamsport.
Arthur Davison Badgley,	E.E.,	Bethlehem.
Francis Hoskins Baldwin,	E.E.,	Atlantic City, N. J.
Hasell Wilson Baldwin,	E.E.,	Rochester, N. Y.
Lewis Warrington Baldwin,	E.E.,	Waterbury, Md.
Springfield Baldwin,	E.E.,	Baltimore, Md.
Charles Herbert Barker,	E.E.,	Marant Bay, Jamaica.
Ralph Emerson Barker,	E.E.,	Philadelphia.
Geo. Pomeroy Bartholomew,	E.E.,	Jeanesville.
Frederic Bartles,	E.E.,	Williamsport.
Charles C. W. Bauder,	E.E.,	Rheims, N. Y.
Fairfax Bayard,	C.E.,	Washington, D. C.
James George Beach,	Arch.,	Apalachin, N. Y.
Herbert Huebener Beck,	A.C.,	Lititz.
Samuel Edward Beeler,	M.E.,	Hagerstown, Md.
Edgar Tweedy Belden,	C.E.,	Stamford, Conn.
†Thomas Francis Bell,	M.E.,	Shenandoah.
†William W. M. Bending,	C.E.,	Philadelphia.
Moriz Bernstein,	C.E.,	Philadelphia.
Warren Joshua Bieber,	Clas.,	Bethlehem.
Rollin Ashley Blakslee,	E.E.,	Weatherly.
Daniel William Yost Bliem,	C.E.,	Pottstown.
Charles Frederick Boers,	E.E.,	Bethlehem.
Lawrence Leander Borden,	C.E.,	Fall River, Mass.
†Madison Brown Bordley,	E.E.,	Centreville, Md.
†William Lebbeus Bosbyshell,	E.E.,	Philadelphia.
Benjamin Franklin Bossert,	C.E.,	Phoenixville.
Howard Franklin Boyer,	Sci.,	Springtown.
Albert Emil Braeunlich, jr.,	M.E.,	Hammondsport, N.Y.
Edward Elisha Bratton,	C.E.,	Lewistown.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Frank Shepard Bromer,	M.E.,	Schwenksville.
Daniel John Broughal,	A.C.,	South Bethlehem.
Walter Everette Brown,	E.E.,	Stamford, Conn.
Maximilian Joseph Bucher,	A.C.,	Columbia.
John Buckland,	C.E.,	Hokendauqua.
George Buckman,	E.E.,	Penn Valley.
George Amandus Buvinger,	M.E.,	Dayton, O.
Robert Berdell Cable, jr.,	M.E.,	Bethlehem.
Edgar Carbonne y Reyes,	M.E.,	Havana, Cuba.
Aaron Beaumont Carpenter,	E.E.,	Avondale.
Malcolm Carrington,	E.E.,	Richmond, Va.
*Amado Cavazos(h),	M.E.,	Saltillo, Mex.
Townsend Dutton Clarke,	M.E.,	Buffalo, N. Y.
†DeWitt Clinton,	M.E.,	Buffalo, N. Y.
Edgar Thomas Conley,	M.E.,	Fairland P.O., Md.
George Henry Cox, jr.,	E.E.,	Towanda.
Frank Hearne Crockard,	C.E.,	Benwood, W. Va.
Eckley SamuelCunningham,	M.E.,	Drifton.
Frederic Allyn Daboll,	C.E.,	Plainfield, N.J.
Charles Stanley Davis,	E.M.,	Reynoldsville.
Eckford Craven DeKay,	C.E.,	New York City.
Samuel Moses Dessauer,	Arch.,	Montrose.
William Carter Dickerman,	M.E.,	Milton.
Patrick Edward Dinan,	A.C.,	South Bethlehem.
Louis Diven,	E.E.,	Elmira, N. Y.
George Armstrong Dornin,	M.E.,	Norfolk, Va.
Earle Billings Douglass,	M.E.,	Allentown.
*Henry John Downs,	Arch.,	Steelton.
Frank Oliver Dufour,	C.E.,	Mitchellsville, Md.
Edward Miall Durham, jr.,	C.E.,	Vicksburg, Miss.
Edward Hiram Dutcher, jr.,	M.E.,	Bridgeport, Conn.
Timothy Sharpe Eden,	E.E.,	Brown's Town, Jamai-
George Ramsey Enscoe,	C.E.,	Bennett P.O. [ca.
William Alvin Evans,	E.M.,	Summit Hill.
†Louis Oscar Fanck,	C.E.,	Lockport, N.Y.
Francis Edward Fenner, jr.,	A.C.,	South Bethlehem.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Luis Fernandez,	C.E.,	San José, Costa Rica.
Charles Victor Ferriday,	M.E.,	South Bethlehem.
Charles Albert Andrew Fink,	M.E.,	Yonkers, N. Y.
Adolph Frey,	E.M.,	Pittsburgh.
*James Gallagher,	E.E.,	South Bethlehem.
Thomas Joseph Gannon,	M.E.,	South Bethlehem.
James Brown Given,	E.E.,	Carlisle.
Harding Murdoch Gow,	E.E.,	Washington.
John Savage Graff,	E.M.,	Williamsport.
William Morris Greenwood,	E.E.,	Bethlehem.
John Lewis Gross,	M.E.,	Allentown.
David Hall,	C.E.,	Fayetteville, Tenn.
Charles Edwin Hammond,	C.E.,	Geneva, N. Y.
William Thomas Hanly,	C.E.,	Philadelphia.
Albert Wilfred Harned,	M.E.,	Philadelphia.
Arthur Wellesly Hazel,	E.E.,	Philadelphia.
Howard Drysdale Hess,	M.E.,	Philadelphia.
Berry Hiss,	A.C.,	East Orange, N. J.
Edward Eugene Holeman,	E.E.,	Mt. Holly, N. J.
Norman M. Holmes,	C.E.,	Stroudsburg.
Ross Nathaniel Hood,	E.E.,	Duncannon.
Oliver Zell Howard,	M.E.,	Hagerstown, Md.
†Walter Howard,	M.E.,	Hagerstown, Md.
*Robert Parsons Howell,	C.E.,	Blairstown, N. J.
Garrett Hulst,	E.M.,	Rapid City, S. D.
James Madison Jackson,	M.E.,	Parkersburg, W. Va.
William Steell Jackson,	E.E.,	Duncannon.
Victor Emanuel Jacot,	A.C.,	South Bethlehem.
Harvey B. Johnson,	A.C.,	South Bethlehem.
Edward Joseph Kehoe,	E.E.,	South Bethlehem.
*Peter Martin Keller,	A.C.,	Palmyra, N. J.
†Victor Witmer Kline,	C.E.,	Lockport, N. Y.
Robert Edwin Kresge,	A.C.,	South Bethlehem.
Edward John Kuhns,	A.C.,	Lehighton.
Robert Edward Laramy,	Clas.,	Bethlehem.
Ernest Tisdel Lefevre,	E.M.,	Panama, U.S. Col.

* Not clear of conditions.
† Excused.

	Course.	Residence.
John George Lehman,	M.E.,	Bethlehem.
Telford Lewis,	E.M.,	Blairsville.
Oliver CharlesLichtenwalner,	E.E.,	Haafsville.
William Cleaver Lindo,	C.E.,	Watsonville, Jamaica.
†John Thomas Little,	A.C.,	Hokendauqua.
Charles Victor Livingston,	E.E.,	Kingston, N. Y.
Bruce Emerson Loomis,	E.E.,	Wilkes-Barre.
Caleb Wheeler Lord,	M.E.,	Lebanon.
Charles Frederick Loshe,	E.E.,	Stamford, Conn.
Hasbrouck L. Ludlum,	E.E.,	Pompton, N. J.
Clifford Sherron MacCalla,	E.E.,	Philadelphia.
Lee Holmes Marshall,	M.E.,	Allegheny.
James Gordon Mason,	E.M.,	West Pittston.
Victor Emanuel Masson,	A.C.,	Hammondsport, N. Y.
Richard Everard Meade,	E.M.,	Birmingham, Ala.
Esteban Angel Mercenario,	M.E.,	Vera Cruz, Mex.
Edward Williamson Miller,	E.M.,	Bethlehem.
Elmer Wesley Mitchell,	C.E.,	Fall River, Mass.
Barry Mohun,	C.E.,	Washington, D. C.
Charles Howard Morgan,	E.E.,	Maxatawny.
*William Hitz Mussey,	E.E.,	Washington, D. C.
John Henry Myers,	C.E.,	Lewistown.
†Ellicott McConnell,	M.E.,	Philadelphia.
Daniel Francis McKee,	E.M.,	Bethlehem.
Hugh Nevins,	C.E.,	Hokendauqua.
Franklin Oberly,	E.E.,	Bethlehem.
Charles Henry Olmsted,	E.E.,	East Hartford, Conn.
Louis Atwell Olney,	A.C.,	Providence, R. I.
John O'Reilly,	A.C.,	South Bethlehem.
Miles Hallacker Orth,	C.E.,	Williamsport.
Horace Lucius Palmer,	C.E.,	Frenchtown, N. J.
Harry Richards Peck,	M.E.,	Scranton.
Charles Warren Pettit,	C.E.,	Elmira, N. Y.
George Samuel Post,	A.C.,	Wilkes-Barre.
Godwin Hall Powell,	E.M.,	Llanidloes, Wales.
Paul Powers,	A.C.,	Youngstown, O.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Morris Havens Putnam,	E.E.,	Tioga.
Samuel Jackson Randall,	E.E.,	Philadelphia.
James Lee Rankin, jr.,	E.E.,	Savannah, Ga.
Henry Paul Reed,	E.E.,	New London, Conn.
Charles Edward Remaly,	E.E.,	Moorestown.
John David Richards,	C.E.,	Columbus, Miss.
Chester Dawson Richmond,	E.E.,	Chattanooga, Tenn.
†Harold Chase Ridgely,	E.E.,	Annapolis, Md.
*George Brydges Rodney,	C.E.,	New Castle, Del.
Henry Felthousen Russell,	M.E.,	Buffalo, N. Y.
Auguste Leopold Saltzman,	C.E.,	Plainfield, N. J.
Charles Fred Sanders,	C.E.,	Kutztown.
Joseph Israel Seigfried,	A.C.,	South Bethlehem.
John Cornelius Sesser,	C.E.,	Saint Joseph, Mich.
Gwynne Harris Sharrer,	E.E.,	Westminster, Md.
Arthur Yeager Shepherd,	M.E.,	Wilkes-Barre.
John Leefe Sheppard, jr.,	M.E.,	Charleston, S. C.
Henry Shriver, jr.,	M.E.,	Cumberland, Md.
*Joseph Henry Siegel,	E.M.,	Salt Lake City, Utah.
John Thomas Simpson,	Arch.,	Kittanning.
Jonathan Edward Slade,	C.E.,	Chicago, Ill.
Antes Latrobe Snyder,	C.E.,	Blairsville.
Norman Alexander Speirs,	E.E.,	Bethlehem.
Harvey Wilson Sprague,	M.E.,	Bethlehem.
Alvin Riegel Sterner,	E.E.,	Bethlehem.
Ambrose B. Strickler,	M.E.,	Waynesboro.
Edward Ernest Taylor,	M.E.,	Ft. Wayne, Ind.
William Bailey Taylor,	E.E.,	Bethlehem.
John Williams Thomas,	E.E.,	Hokendauqua.
John Augustus Thomson,	E.M.,	Summit Point, W.Va.
Columbus William Thorn,	C.E.,	Washington, D.C.
†Edward Coppée Thurston,	E.M.,	South Bethlehem.
Joseph Wharton Thurston,	Clas.,	South Bethlehem.
Alfred Dana Tidball,	E.E.,	New York City.
William Tidball,	E.E.,	New York City.
*Curtis Edwards Trafton,	E.E.,	Fall River, Mass.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Harry Conklin Tripp,	M.E.,	Millerton, N. Y.
*William Edward Underwood,	E.E.,	Lancaster.
Nicanor Valdez, jr.,	M.E.,	N. Laredo, Mexico.
Charles Parker Wagoner,	C.E.,	Phœnixville.
John Scofield Wallace,	E.M.,	New Castle.
Clarence Earl Weaver,	M.E.,	Bradford.
Frank Thomas Weiler,	E.E.,	Pequea.
Harry Edgar Wheeler,	A.C.,	Birmingham, Ala.
David Sheibley Wert,	E.E.,	Carlisle.
*Henry Creil Whitaker,	M.E.,	Wheeling, W. Va.
Allan Hart Whiting,	E.E.,	New York City.
David William Wilson, jr.,	Arch.,	Brooklyn, N.Y.
John Moore Wilson,	C.E.,	New Castle, Del.
Jay Roberts Wilson,	E.E.,	Bethlehem.
Arthur Romain Womrath,	M.E.,	Pottsville.
George Fred. Y. Womrath,	E.E.,	Pottsville.
Alfred Mahlon Worstall,	E.E.,	Millville, N. J.
George Livingston Yates,	E.E.,	Carlisle.
Ignacio Maria Zertuche,	E.M.,	Matehuala, Mexico.

* Not clear of conditions.

SPECIAL STUDENTS.

	Course.	Residence.
Samuel William Briscoe,	E.M.,	Baltimore, Md.
William Jacob Hiss, jr.,	E.E.,	East Orange, N. J.
George Diller Landis,	C.E.,	Landis Valley.
William Sprague Maharg,	A.C.,	Bethlehem.
Robert Melvin Tarleton,	E.M.,	Baltimore, Md.
John Moore Van Cleve,	E.E.,	Sewickley.
Abelardo Velasco,	C.E.,	City of Mexico, Mex.
Frank Shriver West,	A.C.,	Philadelphia.

SUMMARY OF STUDENTS BY STATES.

Vermont,	1
Massachusetts,	10
Rhode Island,	5
Connecticut,	8
New York,	54
New Jersey,	36
Pennsylvania,	288
Delaware,	2
Maryland,	41
District of Columbia,	25
Virginia,	8
West Virginia,	7
North Carolina,	2
South Carolina,	4
Georgia,	6
Alabama,	3
Mississippi,	4
Kentucky,	3
Tennessee,	6
Ohio,	9
Indiana,	2
Illinois,	5
Michigan,	1
Minnesota,	4
Iowa,	1

Missouri,	1
Kansas,	2
South Dakota,	1
Montana,	1
California,	2
Utah,	1
Indian Territory,	3
Nova Scotia,	1
Mexico,	5
Cuba,	5
Jamaica,	4
Porto Rico,	1
Central America,	2
U. S. of Colombia,	3
Wales,	1
Japan,	1
	569

SUMMARY OF STUDENTS BY CLASSES AND COURSES.

	Graduates.	Seniors.	Juniors.	Sophomores.	Freshmen.	Specials.	Totals.
Classical,	4	3	1	7	3	—	18
Latin-Scientific,	1	1	—	1	—	—	3
Science and Letters,	1	1	—	3	1	—	6
Civil Engineering,	8	26	24	52	42	2	154
Mechanical Eng.,	2	7	23	27	46	—	105
Mining Eng.,	12	5	11	17	17	2	64
Electrical Eng.,	2	11	25	40	65	2	145
Analytical Chem.,	7	11	9	14	19	2	62
Architecture,	2	—	2	3	5	—	12
Totals,	39	65	95	164	198	8	569

THE LEHIGH UNIVERSITY.

ORIGIN.

The Hon. Asa Packer, of Mauch Chunk, during the year 1865, appropriated the sum of $500,000, to which he added one hundred and fifteen acres of land in South Bethlehem, to establish an educational institution in the rich and beautiful Valley of the Lehigh. From this foundation rose The Lehigh University, incorporated by the Legislature of Pennsylvania in 1866. In addition to these gifts, made during his lifetime, Judge Packer by his last will secured to the University an endowment of $1,500,000, and to the University Library one of $500,000.

DESIGN.

The original object of Judge Packer was to afford the young men of the Lehigh Valley a complete education, technical, literary, and scientific, for those professions represented in the development of the peculiar resources of the surrounding region. In furtherance of this purpose instruction is liberally provided in Civil, Mechanical, Mining, and Electrical Engineering, Chemistry, Metallurgy, Architecture, and in all needful collateral studies. A School of General Literature is also established and thoroughly equipped, with three departments, called respectively the Classical, the Latin-Scientific, and that of Science and Letters. These departments are kept up to the standard, and the requirements for entrance are the same as those of our best Classical and Literary institutions.

TUITION.

The following charges are made for tuition:

For students in the Technical courses, $100 per annum, —$40 for the first term, $60 for the second term; for stu-

dents in the school of General Literature, $60 per annum, —$25 for the first term, $35 for the second term.

These fees include all tuition, with the use of the Library and Gymnasium, but the student is charged for materials and apparatus consumed in the Laboratories.

The Trustees have placed at the disposal of the Faculty a number of free scholarships, to be awarded to applicants of good moral character who shall pass the entrance examinations creditably, and who for other cause shall be regarded as worthy by the Faculty.

Applications for these free scholarships should be made to the President of the University.

All fees for tuition are payable to the Treasurer of the University within thirty days after the opening of the term.

PUBLIC WORSHIP.

Prayers are held in the Packer Memorial Church of the University every morning and all students are required to be present.

Divine service is held every Sunday morning in the church. The service is according to the forms of the Protestant Episcopal Church, under whose auspices the University was placed by its Founder. Attendance is required of every student, except in case of those connected with other religious bodies, to whom the President will grant permission at the beginning of each term (if requested by the parent or guardian, or by the student himself if he be 21 years of age) to attend during that term the place of worship of the body with which he is connected, where attendance on Sunday morning will be required.

SITE.

The situation of the institution is healthful and beautiful. The region is famous for its railway and manufacturing enterprises; it possesses some of the richest iron and coal mines in our land, and thus gives the students rare

facilities for confirming the teachings of the recitation room by the observation of the eye.

The University buildings are about a half-mile from the depot, at the junction of the Lehigh Valley and North Pennsylvania Railroads. New York is ninety-two and Philadelphia fifty-seven miles distant.

BUILDINGS.

PACKER HALL,

named after the Founder, stands seven hundred feet back of Packer Avenue, at the base of the South Mountain. It is built of stone, and contains lecture and recitation rooms, the drawing rooms, and the museum of geology and natural history.

THE CHEMICAL LABORATORY

is thoroughly fire-proof, is built of sandstone, and is 219 feet in length by 44 in width.

There are two principal stories and a basement. The upper floor is occupied by the quantitative and the qualitative chemical laboratories, the former accommodating 48 and the latter 84 students. These rooms are 22 feet in height, and are well lighted and ventilated. A laboratory for industrial chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a recitation room, a chemical museum, and laboratories for organic, physiological, agricultural, and sanitary chemistry.

In the basement is the large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis, also rooms containing the apparatus for several processes in industrial chemistry, the engine and air-pump for vacuum filtration, a store room, and the toilet.

A photographic laboratory is located in the third story of the central portion of the building.

THE METALLURGICAL LABORATORY

contains a lecture room, a blowpipe laboratory for class instruction in blowpipe analysis and in the practical deter-

mination of crystals and minerals, a museum for mineralogical and metallurgical collections, a mineralogical laboratory provided with a Fuess reflecting goniometer, a polariscope, a Groth's "universal apparat," and a Rosenbusch polarizing microscope, a dry laboratory provided with furnaces for solid fuel and for gas with natural draught and with blast, and a wet laboratory for ordinary analytical work. It is arranged for the instruction of classes in the courses of mineralogy, metallurgy, and blowpipe analysis of the regular curriculum, and to afford facilities to a limited number of advanced students for familiarizing themselves with the methods of measurement and research employed in mineralogy and metallurgy, and for conducting original investigations in these departments of science.

THE PHYSICAL LABORATORY

has been much enlarged. In addition to the three-story building which formerly constituted the laboratory, it now comprises Christmas Hall, which has been almost entirely devoted to this purpose. In the original building a large lecture-room with a seating capacity of 150 occupies a portion of the second and third floors. The lower floor is devoted to the use of the students in electricity. A large room nearly 40 feet square forms the main Electrical Laboratory. There are smaller rooms for photometric and spectroscopic work; also private laboratories for instructors, recitation, reading, balance apparatus, and engine-rooms. On this floor a 12-horse power high speed engine supplies the power for the dynamos. In the cellar are a work-shop, battery, and store-rooms.

In Christmas Hall two large rooms have been fitted up as laboratories for the use of the Sophomore and Junior Class in the Electrical Engineering course. They are equipped for work in Mechanics, Heat, and Magnetism. The tower and room in the east end of Christmas Hall are used as a Meteorological Observatory.

The equipment of the Electrical Laboratory has of late been very greatly increased. Several complete electric light plants have been put up in the building, representing

some of the best known systems in the country. A Richter machine supplies two systems of lights, one of 4 arc, the other of 25 incandescent lamps. There is a Thomson-Houston plant, with arc lamps (single and double), incandescent lamps, wall-controller, etc., forming a complete outfit of this system. Also an Edison shunt-wound dynamo of the latest style has been obtained, running 20 incandescent lamps, with all the equipments, regulator, ammeter, pressure indicator, etc. The alternator class of machines is represented by a Westinghouse Pony Alternator, with 15 lamps. Part of these lamps are run by means of a Westinghouse converter. A small De Meriten's machine supplies the current for the field of the alternator. The Department has also a Wenstrom 40-light machine, an Edison 1-horse power motor, and a "Novelty Electric Motor."

The wiring of the electric light plants has been so arranged that some of the lamps of each are available in the photometric rooms for tests of different kinds.

THE NEW PHYSICAL LABORATORY.

This Laboratory, now in process of erection, it is hoped, will be ready for occupancy by the opening of the next collegiate year. The building is of stone, 235 feet in length, and 4 stories in height. The first or ground floor is devoted to electrical work. It contains a large dynamo room, with the engine, dynamos, and motors, with all their appliances; battery, balance, calorimetric rooms and workshops. The eastern part of this story has been carefully arranged for delicate work. The use of iron has been avoided; the gas and steam mains and pipes, radiators, etc., are all of brass. In this section are seven special rooms for investigations of the magnetic properties of iron and original research. A hall over 200 feet in length can be darkened and utilized for long range work in testing lamps. Under this floor is the "cave" or even temperature room, completely enclosed with solid stone masonry. On this and the other 3 floors are private laboratories, store and apparatus rooms, and offices for instructors.

The second story contains the main Electrical Laboratory, 56 by 44 feet; the Mechanical Laboratory, 60 by 44 feet, with tables for 80 students, the Library, a time and two balance rooms, with floors resting on solid stone arches.

On the third floor is a public hall, 70 by 44 feet. for examinations; also the professor's lecture room, 40 by 44 feet, with private laboratories, etc.

On the fourth floor in the west wing are two recitation rooms for the instructors, 40 by 18 feet, and the Heat Laboratory, 44 feet square, with tables for 72 persons. On the east side is the Light Laboratory. This contains one room with tables for 40 persons, and 10 smaller dark rooms, each of which can be divided into two parts. Besides these are 2 photographic dark rooms, 8 by 28 feet, each with all the necessary equipments.

The tower, which is devoted to meteorological purposes, has two stories of one room each, 16 by 21 feet, with a vane room above. Besides these there are several small rooms for special purposes scattered among the four floors.

The tendency in the latest and best Physical Laboratories is towards a larger number of smaller rooms, rather than to a few large rooms. It will be seen from this description that the advantages of this plan have been gained by the many smaller rooms that exist, while for general work the larger halls are provided.

Three staircases at the middle and the two ends of the building afford ample means of entrance and egress.

THE SAYRE OBSERVATORY.

Near Brodhead Avenue is the Sayre Observatory, the gift of Robert H. Sayre, Esq., of South Bethlehem, containing an equatorial and a zenith telescope, transit instrument, and astronomical clock.

THE UNIVERSITY LIBRARY.

To the east of Packer Hall is the University Library, erected by the Founder in memory of Mrs. Lucy Packer Linderman, his daughter.

THE GYMNASIUM

is a handsome and spacious structure, built and equipped with the utmost thoroughness. It is furnished with the best patterns of gymnastic apparatus, besides Dr. Sargent's system of developing appliances. It is provided with hot and cold water; tub, sponge, and shower baths, and 389 clothes closets. Opportunities for recreation and amusement are provided in the bowling alleys. It is under the immediate care of a skilled and competent Director.

All students are required to undergo a physical examination before being allowed the use of the Gymnasium, and this examination will be repeated once each year during their stay at the University. The proper exercise is prescribed and is required of every student. These regulations are designed to promote the harmonious, symmetrical development of the individual student.

EXPENSES.

Books, materials, paper, pencils, materials used in the chemical laboratories, and drawing instruments are furnished by the student. Materials consumed in the chemical laboratories can be obtained from the University, their value being covered by a deposit made at the opening of that term in which the laboratory work is to be done.

Rooms and board can not be had in University buildings, but can readily be obtained in many private houses.

The following is an estimate of the necessary expenses for the collegiate year, clothing and traveling not included:

Tuition, ...		$100	$100
Board for 40 weeks, . . .	from	160 to	200
Room-rent, with fuel and lights .		40 "	80
Care of room and use of furniture, .		5 "	20
Washing and incidentals, . . .		20 "	40
Books, stationery, etc., ...		25 "	50
Total, ...		$350 to	$490

(In the case of students in the School of General Literature, the totals will be $310 to $450.)

NOTE.—If clubs be formed the cost of board need not exceed $3.50 per week.

ADMISSION OF STUDENTS.

The Register is intended to give all necessary information concerning the admission of students. Application may be made to the President of the University if information is desired which is not given in the Register.

DATE OF EXAMINATIONS.

Examinations for admission to the University are held at the opening of each term, and also in June at the close of the academic year.

The examinations for 1893 will be on Tuesday and Wednesday, January 10 and 11, for admission to the second term; on Thursday, Friday and Saturday, June 22, 23 and 24, and on Saturday, Monday and Tuesday, September 9, 11 and 12, for admission to the first term. No other examinations for entrance will be held, except for good cause, and all applicants *must* be in attendance at 9 o'clock on the morning of the first day.

The examinations are held in the following order:

First Day.—English, 9 A.M.; Arithmetic, 11 A.M.; Physics, 2 P.M.; Latin and Roman History, 2 P.M.

Second Day.—Geometry, 8.30 A.M.; Physical Geography, 11.30 A.M.; Geography, 3 P.M.; United States History, 4 P.M.

Third Day.—Algebra, 8.30 A.M.; Greek and Greek History, 2 P.M.

The schedules of examinations for applicants for admission to the Freshman Class at the beginning of the second term and to the Sophomore Class at the beginning of the first term may be obtained from the Secretary of the Faculty. Examinations at other than the appointed times can not be granted without great inconvenience, and candidates so applying will be required to pay a fee of $5 into the Faculty's fund for the aid of indigent students.

CHARACTER OF THE EXAMINATIONS.

The examinations are rigorous and cover the entire ground laid down in the following scheme. They are all conducted in writing, supplemented by an oral examination at the option of the examiner.

Each candidate for admission must be at least sixteen years of age and must present a testimonial of good moral character from his last instructor, or from the school or institute to which he last belonged, or from some reputable citizen of the community in which he lives.

Candidates for admission to

THE CLASSICAL COURSE

will be examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) a thorough knowledge of orthography and the rules for punctuation, use of capitals, division into paragraphs, and the principles of correct English composition, so far as these are included in the ordinary High School text-books in Rhetoric. Candidates are required to write a composition of four hundred words upon a subject announced at the time. The subject in 1893 will be taken from one of the following works: Shakespeare's Henry the Eighth, Scott's Lady of the Lake, Dickens' David Copperfield, Fenimore Cooper's Last of the Mohicans. In 1894 a subject will be taken from one of the following: Bunyan's Pilgrim's Progress, Shakespeare's Julius Cæsar, Tennyson's Ulysses, Scott's Ivanhoe.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution.*

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities.

Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures.

[Chauvenet's Geometry (four books) is recommended, that being the text-book used in the University.]

7. *Physical Geography.*

8. *Latin Grammar.*

9. *Cæsar*, four books of the Gallic war.

10. *Cicero*, six orations, including the four against Catiline.

11. *Vergil*, the first six books of the Æneid, including Prosody.

12. The translation, at sight, of passages from Cæsar and Cicero.

13. The translation of English into Latin. (As special importance is given this part of the examination, it is suggested to teachers that they connect exercises in making Latin, both oral and written, with all the studies of the preparatory course.)

14. *Roman History.*—Creighton, Pennell, or Myers.

15. *Greek Grammar.*

16. *Xenophon*, Anabasis, four books.

17. *Homer*, Iliad, first three books, including Prosody. The Catalogue of Ships may be omitted.

18. The translation, at sight, of a passage from some work of Xenophon.

19. *Greek History.*—Fyffe, Pennell, or Myers (pp. 152–357).

20. Writing Greek with accents.

The pronunciation of Greek according to the written accents is followed in the University, and it is desirable that students preparing to enter be taught this system.

Latin is pronounced according to the method generally known as the Roman Method.

THE LATIN-SCIENTIFIC COURSE.

Candidates for admission to this course must present the first fourteen of the above requirements, but will substitute for the Greek sections (numbers 15–20 inclusive) the following:

21. *Geometry.*—Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles: these constituting the subject matter of Books Five and Six of Chauvenet's Geometry.

THE COURSE IN SCIENCE AND LETTERS.

Candidates for admission to this course are examined in all the subjects demanded of those entering the Latin-Scientific Course, except the Latin and Physical Geography sections (numbers 7–14 inclusive). They will also present the following:

22. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; also Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory by the student and the calculation of problems arising in the work.]

THE SCHOOL OF TECHNOLOGY.

Candidates for admission to the Courses in Civil Engineering, Mechanical Engineering, Mining, Metallurgy, Electrical Engineering, Chemistry, and Architecture will be examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) a thorough knowledge of orthography and the rules for punctuation, use of capitals, division into paragraphs, and the principles of correct English composition. After 1891 candidates will be required to write a composition of four hundred words upon a subject to be announced at the time. The subject in 1893 will be taken from one of the following works: Shakespeare's Henry the Eighth, Scott's Lady of the Lake, Dickens'

David Copperfield, Fenimore Cooper's Last of the Mohicans. In 1894 a subject will be taken from one of the following: Bunyan's Pilgrim's Progress, Shakespeare's Julius Caesar, Tennyson's Ulysses, Scott's Ivanhoe. It is recommended that candidates have a knowledge of Latin Grammar, although an examination in it is not required for any courses except the Classical andthe Latin-Scientific.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution*.

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures. Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles; these constituting the subject matter of the first six books of Chauvenet's Geometry.

[Chauvenet's Geometry is recommended, that being the text-book used in the University.]

7. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; also Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory and the calculation of problems arising in the work.]

Division of Entrance Examinations.

Candidates for admission to the Freshman Class may pass all the examinations in June, or all in September or partly in June and partly in September, or may take them in *two consecutive years*. In the latter case, for the Technical courses and the course in Science and Letters,

candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, and Arithmetic. No credit will be given unless the candidate has passed satisfactorily in at least three subjects at one examination.

The examinations in Algebra, Geometry, and Physics must be passed in June or September of that year in which the candidate proposes to enter the University.

In the Latin-Scientific and Classical courses candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, Arithmetic, Physical Geography, Roman History, and Greek History. No credit will be given unless the candidate has passed at least four of the subjects at one examination.

The examination in Latin may also be divided, but no credit will be given unless the candidate has passed in at least three of the topics specified at one examination. The examination in the remaining subjects must be passed in June or September of that year in which the candidate proposes to enter the University.

Candidates intending to enter the University in September are advised to present themselves for examination in June; if they are not fully prepared at that time they will receive credit for the examinations then satisfactorily passed.

CONDITIONAL ADMISSION.

A candidate failing to pass in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to his class conditionally, to make up his deficiencies by extra study. When they are made up, he will be received into full standing in his class.

SPECIAL STUDENTS.

Young men of advanced standing, who do not desire to take a full regular course, can enter and select special shorter courses, with the sanction of the Faculty; but in all cases satisfactory examinations must be passed upon the subjects required for entrance to the Freshman Class.

ADMISSION TO ADVANCED STUDIES.

Candidates for admission to advanced studies *in any course* are required to pass, *in addition to the entrance examinations for that course*, examinations in the work already done by the classes which they desire to enter. These examinations are held on the same days as those for entrance to the Freshman Class.

The additional subjects may be found in the program of studies.

A diploma showing that a degree has been conferred, or, in so far as it covers the subjects required for entrance, a certificate of studies taken at another College will be received in lieu of the *Primary Entrance Examinations only.*

ADMISSION TO THE POST-GRADUATE COURSE.

Students of this University who have taken their *first* degree, and others, on presenting a diploma of an equivalent degree conferred elsewhere, are admitted to advanced studies, according to the plan to be found in the Register under the general subject of Graduate Students.

PREPARATORY SCHOOL CERTIFICATES

are not accepted so as to dispense with the primary entrance examinations.

NOTE.—The acceptance of a certificate as evidence of proficiency in lieu of examination is at the discretion of each Professor as to the subjects in his department.

PROGRAM OF STUDIES,

Showing the number of exercises per week for each subject, and the Text-books used.

The following is presented as the general program of instruction, subject to such modifications from time to time as the Faculty may deem expedient, with the approval of the Trustees.

The names of the text-books studied are generally mentioned. The number of exercises per week in each subject is indicated by the figure in parentheses immediately following.

Two hours of drawing, three of work in the laboratory, or three of practice in the field, are regarded as equivalent to a recitation or lecture of one hour's duration.

SCHOOL OF GENERAL LITERATURE.

There are three courses in the School of General Literature of the University.

I. The Classical Course includes all that is prescribed in our best institutions for the degree of Bachelor of Arts (B.A.). It covers full instruction in Greek, Latin, English, French and German, Mathematics, Astronomy, Physics, Chemistry, Geology, Physiology, Hygiene, History, Psychology, Ethics, Philosophy, Political Economy, and Constitutional Law.

II. The Latin-Scientific Course differs from the first in omitting Greek, taking in its place an increased amount of the Modern Languages and of Mathematics. Students completing this course receive the degree of Bachelor of Science (B.S.).

III. The Course in Science and Letters, for which the same degree is given as for the last mentioned, contains no Latin or Greek, but furnishes instead extended instruction

in French and German, History, General Literature, Mathematics, and General Science.

Instruction in all of these courses is given both by recitations and by lectures.

DESCRIPTION OF THE COURSES.

GREEK.—During the first term of Freshman year the class reads several books of the Odyssey, giving attention to epic forms and syntax, to prosody and scanning and to Homeric antiquities and mythology. The work of the second term is directed toward a thorough acquaintance with the idiom and vocabulary of Attic prose, as a preparation for rapid reading. The Œconomicus and Symposium of Xenophon and the Crito of Plato are read during the term, with sight readings from the Memorabilia and the Apology; accompanied with discussions of domestic life at Athens. The work of the year includes a thorough review-drill on the principles of Greek accidence and syntax, and exercises in Greek prose composition are required, based, during the second term, on the reading done by the class. Greek history is studied throughout the year, with special reference to the development of political institutions.

The Sophomore class takes up, during the first term, the study of Herodotus and Thucydides. Selections are made from both authors with the purpose of illustrating their best style and at the same time of presenting, from the original sources, the history of certain interesting epochs; the reading from Herodotus, after some drill on the Ionic forms, being in large part at sight. During the second term the class reads one or two plays of Euripides, with attention to the history of Greek tragedy, the life of the author and the analysis of the drama read. The lyric meters are studied, with the aim of gaining a knowledge of the rhythmical and metrical principles of Greek poetry. During this term an elective course is offered, the subject being Greek oratory, with the reading of certain orations of Lysias or Demosthenes, or both.

The Junior year is devoted to a further study of the drama, selected plays of Sophocles, Aristophanes, and Æschylus being read during the year. Work is also done in the study of public and private antiquities, partly in lectures by the professor and partly in original investigation on allotted subjects by the students.

During the first term of the Senior year the class reads either selections from Thucydides, or one of the dialogues of Plato. The second term is in part devoted to the reading of selected odes of Pindar, with careful study of the history of Greek lyric poetry and of the life and work of Pindar in particular. The course concludes with a review of the history of Greek literature, intended to summarize and harmonize the fragmentary views of the general subject gained from the study of particular authors and departments of literature.

LATIN.—Much of the training in the Freshman year is devoted to laying a good foundation in Latin grammar and in the translation of English into Latin. The authors studied are used to illustrate both of these, and a large amount is read at sight in order to cultivate quickness and readiness in the student. Roman history is begun, accompanied with full comments and lectures upon points of interest. Collateral reading will also be recommended each year throughout the course. Cicero: De Senectute and De Amicitia or the Philippics, Livy, and the Odes and Epodes of Horace are read this year. With the last named, training is given in Latin meters.

During this and the following year courses of lectures will be given upon Roman antiquities in addition to a text-book. The topography of Rome with its remains, ancient life in its various aspects, and the other departments of archæology will be discussed, illustrated by the new and extensive set of over 1800 magic lantern slides which have been prepared for this purpose.

The Sophomore year completes the text-book on Roman history. Prose composition is continued, and the subject of Synonyms taken up in connection with it. Quintilian

(Bk. X) with Crowell's Selections from the Lyric Poets will be read in the first term, and in the second the Agricola and Germania, with selections from the Annals of Tacitus, together with sight reading. An elective in Plautus is offered during this term in addition.

In the Junior year, selected letters of Cicero and Pliny are read, followed by Persius and several plays of Terence. The history of Roman literature is entered upon in the second term.

The work in the Senior year opens with Lucretius, accompanied with lectures on Roman philosophy. The course in the second term this year includes the study of ancient Latin, using Allen's Remnants of Early Latin, supplemented by a series of lectures upon Latin grammar and the history of the development of the language, together with several lectures upon the history of classical philology. Characteristic poems by various authors will be read with full comment and training in the discussion of the literary and critical points which come up.

SANSKRIT.—An elementary course in this study, conducted by the Professor of Latin, is offered as an optional during the Senior year.

HEBREW.—An elementary course in Hebrew, conducted by the Chaplain, is offered as an optional study, open to Seniors and Juniors of the whole University.

ENGLISH.—During Freshman and Sophomore years, Rhetoric is studied, both with the aid of a text-book and through practical exercises. Careful training is given in essay writing throughout the course, and orations are written and delivered during Junior and Senior years. Excellence in Oratory is encouraged by the annual contest for the Alumni Prizes, held on the 22d of February and open to the Junior Class in all departments.

The Seniors receive instruction in the principles of versification and in extemporaneous discussion, and are required to write a critique of some work selected for their examination.

The history of English literature and the philological history of the English language are studied during Junior year. These are supplemented by a series of lectures, extending through the second term, on the relations of literature to history. The course is completed by a series of lectures on English and American literature, delivered during the second term of Senior year.

ANGLO-SAXON.—An optional course in this subject is offered in Senior and Junior years.

MODERN LANGUAGES.—The study of modern languages is obligatory from the first term of the Sophomore year up to the close of the course. The student elects either French or German, or both, if time permits.

French.—The grammar is begun, reading being introduced immediately. The comparative and historical relations of the French to the English, and the connection of both with the Latin are carefully explained. As soon as possible the student is emancipated from the reader and takes up, in a progressive way, the reading of different authors; preference being given to modern writers, because it is considered to be of the highest importance that he acquire the language as it is, as an instrument whereby further knowledge can be obtained.

In the class-room, the language taught is used by the teacher as much as possible, in order that the ear of the pupil may become accustomed to its sound. Dictation is also employed, in order to give training in spelling. The rules of grammar are taught by numerous written exercises. In the second term of the Junior year, compositions in French are required, upon subjects which have been previously explained in French, in order that the student may become acquainted with different expressions and forms of construction. Before entering upon the study of an author's works, his life and literary achievements are discussed in French, which is translated, if necessary. In the Senior year, twelve lectures are delivered upon the history of French literature. In addition to this, lectures in French

upon the most distinguished modern authors are given to advanced students.

A weekly conversation-class affords opportunity for this kind of practice; and in it the events of the day and various historical and literary topics are discussed. Private courses of reading are also suggested to those who desire it.

German.—The German course follows the same plan as that laid down for the French, both as regards the methods employed and the opportunities afforded. The relations of English and German are dwelt upon and also those which connect the two languages with the Indo-European family.

MATHEMATICS.—The mathematical work is carried on during the Freshman and Sophomore years as follows:

Freshman year, first term, Chauvenet's Geometry, four exercises per week.

Second term, Olney's University Algebra, plane and spherical trigonometry, including mensuration and use of logarithmic tables, together five exercises per week throughout the term.

Sophomore year, first term, Olney's General Geometry and Davies' Analytical Geometry, four exercises per week.

Second term, Olney's Differential and Integral Calculus, four exercises per week. This term's work is elective for the Classical Course.

ASTRONOMY.—This study is taken up during the first term of the Senior year, Young's General Astronomy being used as the text-book. There are three exercises a week, and visits to the observatory help to make the work interesting as well as profitable.

CHEMISTRY.—This study includes a complete course of lectures in Freshman year upon general inorganic chemistry, in which the principles of the science are fully covered. These are illustrated by experiments, and are sufficiently extended to enable a student who desires to pursue the subject further to take analytical chemistry as an elective in the second term of the Sophomore year. The text-book used in connection with the lectures is Remsen's Inorganic Chemistry.

PHYSICS.—This important subject is presented in a course of lectures during the first term of the Sophomore year, three times a week. These are illustrated by means of the very complete apparatus of the physical laboratory. In the course in Science and Letters, the work in this branch is more extended and is identical with that given to the Civil and Mechanical Engineers. It occupies five hours a week in the first term, when heat, magnetism, and electricity are discussed. Throughout the second term, three hours a week are devoted to sound and light.

GEOLOGY.—In the second term of the Senior year, a course of lectures is given in connection with Dana's text-book. The general principles of the science are explained, and the theories of the formation and stratification of rocks, the successive periods of the development of the earth's crust, the extinct forms of life and similar questions are treated.

PHYSIOLOGY AND HYGIENE.—These subjects are taught in a course of lectures during the Freshman year.

HISTORY, POLITICAL SCIENCE AND LAW.—The study of history begins with a course in the political antiquities of Greece and Rome. [See the Departments of Greek and Latin.] This is followed by the study of an outline of universal history (with text-book), and this by a fuller study of the political history of recent times, especially of that of England and France. During the first term of Senior year, there is a course of lectures upon the period covered by Gibbon's Decline and Fall of the Roman Empire. This prepares the way for a course of lectures on the philosophy of history, in which it is sought to set forth the scientific methods of the study of history.

The course in history is accompanied and supplemented by courses of lectures on constitutional law with special application to the Constitution of the United States; and also on international law.

Instruction is given by lectures on the elements of political economy. The student is made familiar with the facts, methods, and doctrines of the science, and is encouraged to form and present his own opinions.

LOGIC.—Junior Class, first term, two hours weekly. Textbook, Prof. Jevons' "Lessons in Logic," supplemented by occasional lectures and by references to more extended logical treatises, such as those of J. S. Mill, Sir William Hamilton, Archbishop Thompson, Baynes' Port Royal Logic, etc.

MENTAL AND MORAL PHILOSOPHY.—The work in this department will be conducted chiefly by lectures, interrupted by occasional examinations. The courses at present are the following:

Outlines of Physiological Psychology.—Junior Class, second term. These lectures are founded principally on Wundt's lectures on the same subject, given in the University of Leipzig in the Summer of 1888, Wundt's Grundzüge der Physiologischen Psychologie, James' Psychology, Baldwin's Handbook, Ladd's Elements of Physiological Psychology, Sully's Outlines of Psychology, Carpenter's Mental Physiology, Maudsley's Physiology and Pathology of the Mind, Bain's Mind and Body, etc., with references to the classical works of Lotze, Weber, Fechner, and Helmholtz.

The History of Philosophy.—Senior Class, both terms. First term, Ancient and Medieval Philosophy. Second term, Modern Philosophy. These lectures will include a statement of the conception and problems of philosophy, a brief sketch of the great ethnical religions, and of the history of Oriental philosophy. The philosophy of the Greeks will be treated in detail, with illustrations from the writings of the philosophers.

The history of medieval philosophy will be prefaced by a short description of the philosophical ideas underlying Christianity, and it will contain an account of the more important Church Fathers and Schoolmen.

The history of modern philosophy will begin by tracing the effect on philosophical thought of the ideas contributed by the Renascence and by the Reformation. From Lord Bacon on, a detailed history of the great modern philosophical systems will be given, which will be continued to those of our own times, including Mr. Spencer.

CHRISTIAN EVIDENCES. — Senior Class, second term. Lectures on Christian evidences, which will endeavor to treat of the subject both from the side of natural science and from that of biblical criticism.

No complete course in Ethics has as yet been established, but the history of ethics is included in the history of philosophy.

THE COURSE IN SCIENCE AND LETTERS

substitutes the following for the Latin and Greek:

DRAWING.—In the first term of the Freshman year the student is instructed in elementary projections, shading, and lettering.

ZOÖLOGY AND BIOLOGY.—The study of these subjects covers one year, beginning with the second term of Sophomore year. The work begins with a description of the various animal functions, and is extended to the comparative anatomy and physiology of the organs in typical species. Systematic zoölogy is then completed and followed by the theories of biology.

CHEMISTRY. — In addition to the course in general chemistry described above, three exercises a week in qualitative analysis are taken in the second term of the Freshman year.

MINERALOGY.—Instruction in mineralogy is given to the students in the Course in Science and Letters throughout the Junior year. In the first term, they attend a course of lectures on crystallography, followed by a series of practical exercises in the determination of crystalline forms by the aid of models and natural crystals.

In the second term a course on the physical properties of minerals and on descriptive mineralogy, with the use of E. S. Dana's Text-Book of Mineralogy, is followed by practical exercises in the determination of minerals.

GEOLOGY.—The study of lithology is pursued in the first term of the Senior year, with laboratory practice, Williams' Lithology being used as the text-book. During the next term, the course given above is taken with the Classical and Latin-Scientific students.

THE CLASSICAL COURSE.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

Greek.—Homer: Odyssey. Prosody. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (3)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. Essays. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Pt. III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Greek.—Xenophon: Œconomicus. (3)

Latin.—Livy completed. Horace: Odes and Epodes. Composition and prosody. (4)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

English.—Rhetoric. Essays. (1)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's French Reader. (2) Or *German.*—Brandt's Grammar. Lodeman's Manual of Exercises. Buchheim's Reader. (2)

Greek.—Herodotus and Thucydides. (3)

Latin.—Horace: Satires and Epistles. Composition. (2)

History.—History of Rome. (1) Antiquities.

English.—Rhetoric. Essays. (1)

Gymnasium. (2)

SECOND TERM.

French.—Grammar and reader (continued). (2) Or *German.*—Grammar, exercises, and reader (continued). (2)

History.—Weber's Outlines of Universal History. (2)

Greek.—Euripides: Medea. (3)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—Rhetoric. Essays. (1)

Gymnasium. (2)

In addition to the above exercises, four hours per week must be selected from the following elective studies:

Mathematics.—Differential and integral calculus: Olney. (4)

Greek.—Demosthenes: De Corona. (2)

Latin.—Plautus. (2)

French.—Grammar and reader. (2)

German.—Grammar and reader. (2)

Chemistry.—Stoichiometry and qualitative analysis (laboratory). (4)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Greek.—Sophocles: Electra. Antiquities. (3)

Latin.—Letters of Cicero and Pliny. (3)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Buchheim's Prose Composition. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Greek.—Aristophanes: Clouds. Æschylus: Prometheus. (3)

Latin.—Persius and Terence. History of Roman literature. (3)

Literature and History. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Sadler; Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French literature. (2) Or *German.*—Grammar. Readings in Lessing, Herder, Goethe, Schiller, etc., and contemporary authors. Compositions. Lectures on German literature. (2) Conversation class in both languages optional throughout the year.

Greek.—Plato: Phædrus. Greek philosophy. (2)

Latin.—Lucretius, with lectures. Roman literature. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

French.—Readings. Compositions. Lectures in French on modern French authors. (2) Or *German.*—Readings. Compositions. Lectures in German on modern German authors. (2)

Geology.—Lectures. Geikie. (2)

Greek.—Pindar: selected odes. Greek literature. (2)

Latin.—Cicero: De Officiis, with lectures. (2)

Lectures on American and English Literature. (2)

Essays and Original Orations.

Preparation of Thesis.

Gymnasium.

THE LATIN-SCIENTIFIC COURSE.

The Latin-Scientific Course, leading to the degree of Bachelor of Science (B.S.), is based on Latin without Greek.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

German.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (2)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. Essays. (1) Study of Words. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

German.—Grammar. Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

Latin.—Livy (completed). Horace: Odes and Epodes. Composition and prosody. (4)

English.—Rhetoric. Essays. (1)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German.—Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

Latin.—Horace: Satires and Epistles. Composition. (2)

English.—Rhetoric. Essays. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney. (4)

French.—Grammar. Reader (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

History.—Weber's Outlines of Universal History. (2)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—Rhetoric. Essays. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

Latin.—Letters of Cicero and Pliny. (3)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)

German.—Readings (continued). Dictation. Compositions. (2)

Latin.—Persius, Terence. History of Roman literature. (3)

Literature and History. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Lectures on French literature. (2)

German.—Readings (continued). Compositions. Lectures on German literature. (1) Conversation class in both languages optional throughout the year.

Latin.—Lucretius, with lectures. Roman literature. (2)

Essays and Original Orations.

Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

Geology.—Lectures. Geikie. (2)

Latin.—Cicero: De Officiis, with lectures. (2)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Lectures on American and English Literature. (2)

Essays and Original Orations.

Preparation of Thesis.

Gymnasium.

COURSE IN SCIENCE AND LETTERS.

The Course in Science and Letters, leading to the Degree of Bachelor of Science (B.S.), is designed for those who wish to pursue both scientific and literary studies without Latin and Greek. These being omitted, extended instruction is given in French and German, History, General Literature, Mathematics and General Science.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

German.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Elementary projections, shading and lettering. (2)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. Essays. (2) Study of Words. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

History.—History of Greece. (2). History of Rome. (1)

German.—Grammar. Reader (continued). Bernhardt's Novelletten—Bibliothek, I. (3)

English.—Rhetoric. Essays. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German.—Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus. Olney. (4)

Physics.—Sound and light. Lectures and recitations. (3)

Zoölogy.—Lectures. Orton. (2)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

French.—Grammar. Readings (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. (2)

History.—Weber's Outlines of Universal History. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

Zoölogy.—Lectures on biology. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc, Compositions. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

Literature and History. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French Literature. (2)

German.—Readings (continued). Compositions. Lectures on German Literature. (1)

In both languages conversation class optional throughout the year.

Geology. — Williams' Lithology and laboratory practice. (2)

Essays and Original Orations.

Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Geology. — Historic and dynamic geology. LeConte. (2)

Lectures on American and English Literature. (2)

Essays and Original Orations.

Preparation of Thesis.

Gymnasium.

THE SCHOOL OF TECHNOLOGY.

This school includes seven distinct courses:

I. The Course in Civil Engineering.
II. The Course in Mechanical Engineering.
III. The Course in Mining Engineering.
IV. The Shorter Course in Mining.
V. The Course in Electrical Engineering.
VI. The Course in Chemistry.
VII. The Course in Architecture.

These have the same curriculum of studies for the first term of the Freshman year. At the end of that time the student selects his course and follows its program.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Chauvenet's Geometry (completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

French.—Whitney's Practical French Grammar. Super's Reader. (3) Or *German.*—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Free-hand sketching and lettering. (2)

English.—Rhetoric. Essays. (2)

Physiology and Health.—Lectures. (1)

Gymnasium. (2)

THE COURSE IN CIVIL ENGINEERING.

The special technical studies in this course may be grouped under the heads of Surveying, Applied Mechanics, Road and Railroad Construction, Bridge Design, and Hydraulic and Sanitary Engineering.

The work in Surveying extends over six terms and embraces land surveying, leveling, topography, triangulation, railroad reconnaissance and location, hydrography, and the elements of geodesy. A large equipment of transits, levels, and other surveying tools affords students the

opportunity of becoming familiar with the instruments of different manufacturers. Much time is devoted to practice in the field and drafting room, each student being required to become proficient in the use of instruments, in taking field notes, and in map-drawing. Particular attention is paid to the execution of topographical surveys and maps by the best modern methods. Railroad maps and profiles are made from actual field location. During the Senior year there is done secondary triangulation work of a high order of precision.

The work in Applied Mechanics comprises the strength and elasticity of materials, the theory of the equilibrium of arches, roofs and bridges, that part of the mechanics of machinery which relates to locomotives and hoisting machines, and the theory of hydraulics and hydraulic motors. Here the theoretical principles are illustrated by examples and problems taken as far as possible from actual engineering practice and a special report is required from each student on the testing machines of the Bethlehem Iron Company.

The course in Construction familiarizes the student with the qualities of materials used in engineering structures, with methods of preservation and testing, with masonry and foundations, and with the building and maintenance of roads and railroads. All the standard tests for hydraulic cements and mortars are made by each student.

The course in Bridge Design is preceded by the theory of computation of stresses by both analytical and graphic methods. Starting with the specifications for a first-class iron highway or railroad bridge, each student then makes the full computations, designs, working drawings and bills of material for a plate girder, a lattice girder, and a pin-connected truss bridge. The weight of the designed bridge is finally determined and compared with the dead load assumed for the calculations. The drawings are made and dimensioned in the same manner as in the drafting office of a bridge company. In connection with this course visits of inspection to bridges in the vicinity are regularly made.

The work in Hydraulic and Sanitary Engineering embraces the study of systems of water supply, the collection, purification and distribution of water, the combined and the separate systems of sewerage, the methods for the disposal of sewage, and the best practice for the drainage and ventilation of houses. The hydraulic laboratory in the University Park affords opportunity for experiments on the actual measurement of water by means of weirs and orifices, and the testing of hydraulic motors.

Besides these special studies there is a course in astronomy, which includes practical work in the observatory. The study of English, and of French or German, is continued, and instruction is given during four terms in crystallography, mineralogy, lithology, and geology.

The student who completes all the studies of this course will receive the degree of Civil Engineer (C.E).

FRESHMAN CLASS.

FIRST TERM.

See page 65.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Surveying.—Theory of chain and compass surveying. Computation of areas. Elements of leveling. (1)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Descriptive geometry and isometric drawing. Tracings. Warren's Elementary Projection Drawing. (4)

English.—Rhetoric. Essays. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—Architectural drawing. Plans of piers and arches. (2)

Surveying.—Use of compass, level and transit. Surveys and maps of farms. Colored topography. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and light. Lectures and recitations. (3)

French.—Grammar. George Sand: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Surveying.—Profiles and contour maps. Hydrographic and city surveying. Use of the plane table. Topographical drawing. (3)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus, and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Surveying.—Triangulation. Leveling. Topographical surveying with transit and stadia. Topographical map. (4)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Construction.—Materials of construction. Masonry. Foundations. Theory of retaining walls and stone arches. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. Lectures on construction and maintenance. (4)

Roofs and Bridges.—Theory and calculations of strains in roof and bridge trusses. Graphic statics. (4)

Construction.—Stone cutting, with working drawings. (3)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Astronomy.—Young's General Astronomy. (3)

Bridges.—Suspension, continuous, and cantilever bridges. Design of plate girders and riveted bridges, with working drawings. (6)

Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (3)

Mechanics of Machinery.—Pile drivers, cranes and elevators. The mechanics of the locomotive. (2)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (2)

Gymnasium.

SECOND TERM.

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Bridges.—Design of pin-connected bridge, with working drawings. (3)

Hydraulics.—Hydrostatics. Efflux of water from orifices and flow in pipes and rivers. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Hydraulic and Sanitary Engineering.—Collection, purification and distribution of water. Systems of water supply. The combined and the separate system of sewerage. Disposal of sewage. House drainage. (4)

Geology.—Historic and dynamic. Geikie. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN MECHANICAL ENGINEERING.

The object of this course is the study of the Science of Machines. The principal subjects taught are: The nature, equivalence, and analysis of mechanisms, the mechanics or theory of the principal classes or types of machinery, Mechanical Technology, and the principles and practice of Machine Design.

That the students may obtain the practical engineering data which they will most need when beginning their work as mechanical engineers they are required to pursue a course of Shop Instruction which does not necessarily involve manual labor and manipulation of tools, but is principally devoted to familiarizing them with those points in pattern-making, moulding, forging, fitting and finishing,

which they need to know as designers of machinery. Particular attention is therefore directed to the forms and sizes of machine parts that can be readily constructed in the various workshops, to the time that it takes to perform, and the order of, the various operations, to the dimensions most needed by workmen and to the various devices for increasing the accuracy of the work, durability of the parts, and convenience of manipulation. This involves acquaintance with the processes and machinery of the workshops, but it is the foreman's and superintendent's knowledge which is required rather than the manual dexterity and skill of the workman and tool-hand. The acquirements peculiar to the latter are by no means despised and the students are encouraged to familiarize themselves therewith during leisure hours, but manual work in the shops forms no regular part of the course. On the contrary, the student enters the shop with hands and mind free to examine all processes, operations, and machinery, and is ready at the call of the teacher to witness any operation of special interest. Provided with note-book, pencil, calipers, and measuring rule, the student sketches the most important parts of the various machine-tools, notes down the successive steps of each of the important shop-processes as illustrated by the pieces operated upon, and follows the pieces of work through the shops from the pig or merchant form to the finished machine.

That the students may learn to observe carefully and be trained to think and observe for themselves in these matters, there is required of them a full description of the various processes, operations, and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings, and finished pieces, which are not being constructed in the shops at the time and the blue prints for which have been given to them on entering the shops. The student's work is directed not only by these drawings and by the printed program given him at the start, but also personally by a teacher, who accompanies him into the shops, gives necessary explanations, and tests

the extent and accuracy of his knowledge by examining the sketches and notes and by frequent questioning. Finally the results of the observations and the sketches are embodied in a memoir.

During the course there are frequent visits of inspection to the Bethlehem Iron Company, the L. V. R. R. Shops at Easton, and other engineering works both in and out of town, with special reference to such subjects as machine elements, prime movers, machinery for lifting, handling and transporting, and machinery for changing the form and size of materials. It is intended that each of these excursions shall have some definite purpose in view which must be fully reported by the students. These visits are also made the occasion for constant practice in the free-hand sketching of machinery.

The instruction in Machine Design begins with second term of the Freshman year and is continued throughout the course. At first tracings and blue prints of good examples of machine drawings are made. A thorough drill in projection drawing follows; in this work free-hand sketches are first made, and measurements taken, of machine pieces; these sketches are then converted into full-size working drawings. Then there is considerable practice in the interpretation of such drawings, and general views of lathes, planers, drills, and shapers are made from the drawings of the details. This is followed by difficult projections and intersections and exercises in the empirical proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice and the drawings made full size. During the Junior year the class takes up the design of a high-speed steam engine, every dimension being determined by the students and complete drawings made. During the Senior year the students undertake the calculations, estimates, and working drawings involved in the design of a simple but complete machine, each student being en-

gaged upon a different machine. From the finished drawings of each machine tracings are made and then blue prints taken for distribution among the other members of the class. In the case of the machines and of the engine the general plan or arrangement will be given to the students in the form of rough sketches, photographs or woodcuts. In the last term the students are expected to make original designs for simple machinery, whose object has been fully explained. Throughout the course the work in the draughting-room is carried on as nearly as possible like that of an engineering establishment, and special attention is paid to methods of expediting the work of calculation by means of simple formulas, tables, and diagrams.

The graduates in this course will receive the degree of Mechanical Engineer (M.E.).

FRESHMAN CLASS.

FIRST TERM.

See page 65.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing and Machine Design.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (5)

English.—Rhetoric. Essays. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

Machine Design.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers, and connecting rods. (2)

Visits of Inspection.—Examination and sketching of principal machine parts in the shops of the vicinity. (2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and Light. Lectures and recitations. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Steam Engine.—Holmes' Steam Engine. (3)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Mechanical Technology.—Shop instruction. Examination of the processes and appliances involved in pattern-making, moulding, forging, fitting, and finishing, with sketches and reports. (7)

Boilers.—Wilson. Strength, construction, and wear and tear of boilers. (1)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on experimental tests. (4)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Kinematics of Machinery.—Reuleaux. Nature and equivalence of mechanisms. (3)

Machine Design.—Calculations and working drawings for a high-speed steam engine. (5)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Machinery of Transmission.—Weisbach-Herrmann. (2)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Thermodynamics.—General principles; application to steam engines and air compressors. (3)

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Machine Design.—Calculations and working drawings for hoisting, pumping, and metal-working machinery. (4)

Kinematics.—Diagrams of the changes of position, speed and acceleration in mechanisms. Link and valve motions. Quick return motions. Parallel motions. Laying out of cams. (3)

Mechanics of Machinery.—Weisbach-Herrmann. Hoisting machinery, accumulators, cranes, and locomotives. Graphical statics of mechanisms. (4)

Gymnasium.

SECOND TERM.

Mechanics of Machinery.—Weisbach-Herrmann. Pumps, pumping engines, blowing engines, compressors, and fans. (4)

Machine Design.—Original designs. (5)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSES IN MINING ENGINEERING.

These courses aim to fit the student for practical work in either of the branches of mining, metallurgy, metallurgical chemistry, or geology. On account of the great number and scope of the studies necessary to the attainment of the degree of Engineer of Mines (E.M.), which includes that of Metallurgist, five years are required. At the end of the fourth year the student will have completed a course similar to that leading to the scientific degree in other institutions, and will receive the degree of Bachelor of Science (B.S.). On completing the first year, those who desire to practice mining alone are provided with a special course leading to the degree of Bachelor of Science (B.S.) in mining. The following program of subjects and studies shows the requirements for the degree of Engineer of Mines.

MODERN LANGUAGES.—Although the option of studying French or German lies with the student, it may be well to note that the current literature of the subjects taught in these courses is more abundant in the latter language.

DRAWING AND CONSTRUCTION.—The course in machine design begins in the second term of Freshman year with tracings of good examples of machine drawings; then follow the interpretation of such drawings, and the making of general views of machines from detailed sketches; exercises in projection drawing from the same, and the proportioning of simple tools and machines. In Sophomore year the student becomes acquainted with the arrangement and details of metallurgical plant and in Senior year he designs the same. The post-graduate, during the entire year, becomes acquainted with and designs mining plant. The field work in mining and geological surveying is followed by map construction from field notes. Practice in mining and metallurgical construction is also afforded by the projects.

CHEMISTRY.—The course in theoretical and applied chemistry extends over three years and includes work in wet and dry assaying of all the important ores and metallurgical products met with in actual practice, combined with the working of stoichiometric problems and the study of chemical philosophy. The practical work is that required for a metallurgical chemist or assayer.

With moderate care the expenses in this department need not exceed $120.

MINERALOGY.—This subject is divided into two courses. In the first course, after a short exposition of the laws of crystallography and a description of crystalline forms, practical exercises are held in the determination of simple and complex crystals, in which the student is taught to identify the various crystalline forms observed in minerals by the aid of models and of actual crystals, and with the use of the application goniometer. The second course includes the subjects of physical, descriptive, and determinative mineralogy. As in the first course, the greater part of

the time is devoted to practical exercises, which, in this course, have for their object the determination of minerals. Each student is thus enabled to become familiar with the more common minerals by the actual handling of several hundred specimens, with the facility of making such tests as will not injure them. The presence of one or more instructors during each exercise permits the student to make frequent reports of his determinations, and to receive much instruction as to the characteristics of the minerals. The knowledge thus acquired can be supplemented by visits to the museum.

The course in blowpipe analysis may be considered as auxiliary to the practical exercises in determinative mineralogy. In the latter the student is urged to rely chiefly on physical tests; in the former he is required to determine minerals by the aid of the blowpipe.

The mineralogical laboratory offers facilities for an advanced course in crystallography and in physical and microscopic mineralogy to a few students who may receive permission to pursue such a course.

GEOLOGY.—This subject is studied with special reference to the needs of the mining engineer. Within a radius of twenty miles the student meets and becomes acquainted with the rocks of the archæan, the palæozoic, and the mesozoic formations, and makes geological maps from his own field notes, paying attention to the lithological characters of the formations, as they are mainly non-fossiliferous. An extended practical course in lithology familiarizes the student with the rocks of importance to the mining engineer and enables him to determine them by sight. There are over 2000 specimens in the collection, embracing all the known species. The course in historic geology is illustrated by a cabinet of typical specimens. The course in economic geology supplements the above work by familiarizing the student with the geological horizon of all the valuable constituents of the earth's crust and the theories of their formation.

ASTRONOMY.—After studying the theory of the subject two thirds of the year are devoted to practical work in the observatory.

APPLIED MECHANICS.—This embraces hydraulics, a study of the steam engine, and the mechanics of machines employed in mining and metallurgy.

SURVEYING.—A course extending over five terms offers practice in land, mine, and geological surveying, leveling, topography, triangulation, and railroad reconnaissance and location. It also includes practical work in drawing and map construction.

METALLURGY.—There are two courses of, together, about one hundred and forty lectures upon this subject, which extend throughout a year. In these the chief object kept in view is a clear presentation of the principles involved in the various metallurgical processes, looked upon as the application to practice of the laws of chemistry, physics, and mechanics. This is followed, in the case of each process, by a description of the more important examples of the plant and of the methods of conducting the process, and by indications concerning its economic features. In order to ensure that the student shall understand the fundamental principles of metallurgy, and shall become so familiar with them as to be able readily to apply them, he is required to solve a series of problems in which these principles are involved. Many of the problems are such as are likely to present themselves to the metallurgist in his current practice.

The metallurgical laboratory affords opportunity for special investigations in subjects connected with metallurgy to such advanced students as are competent to conduct them.

MINING.—This subject is covered by three courses. The first begins with the application of economic geology to the needs of the engineer, so that he can study and value mining properties, locate appropriately the necessary plant,

and calculate the cost of production. It includes the discussion of faults and the means of finding faulted bodies, with practical problems. The subjects of blasting, timbering, and winning deposits are applied to actual cases, as tunnel-driving, etc., and problems from practical data are solved by the students. The second course covers the subjects of underground and surface haulage; loading, unloading, and stocking ores; pumping; ventilation; hygiene and mining law. A series of problems is given in each of these subjects to cover cases that meet the engineer in ordinary practice. The third course treats of the mechanical preparation of ores by the wet, dry, or magnetic methods, and especially of the preparation of anthracite coal.

The location of the University in the vicinity of the iron works of the Lehigh Valley, and especially of the extensive establishment of the Bethlehem Iron Company, affords unusual facilities for the practical study of iron metallurgy. The processes for the manufacture of spelter and oxide of zinc may be studied at the Bethlehem Zinc Works. The facilities for the practical study of mining and economic geology are not excelled by those of any other institution in the country. The zinc mines at Friedensville, the paint ores of the Marcellus formation, and the brown hematite and slate deposits of the Lehigh Valley are in the immediate vicinity, while within easy reach by rail are the semi-bituminous and anthracite coal fields, the block and fossil iron ores of the Clinton measures, the iron mines at Cornwall, Pennsylvania, and the iron and zinc mines of New Jersey; together affording examples of nearly all the methods of winning and dressing valuable deposits. Numerous visits of inspection are made in connection with the work of the course, to familiarize the student with metallurgical and mining processes and afford data for practical examples and projects.

THE COURSE IN MINING ENGINEERING.

This course is arranged so that the subjects which prepare the student for practice in the field of metallurgy shall be completed at the end of four years, when the graduate will receive the degree of Bachelor of Science in Metallurgy (B.S.). By remaining a year longer, and taking the subjects laid down for the post-graduate year, the graduate in the course may obtain the degree of Engineer of Mines (E.M.).

FRESHMAN CLASS.

FIRST TERM.

See page 65.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

French.—Grammar and reader (continued). (3) *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches. General views from given details. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., illustrated from examples of mining and metallurgical plant. Graphical problems illustrating the direction and extent of throw in faults. (5)

Surveying.—Theory of chain and compass surveying. Computation of areas. Elements of leveling. (1)

English.—Rhetoric. Essays. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—General views of metallurgical plant and detailed sketches. (2)

Surveying.—Use of the level and transit. Surveys and maps of farms. Colored topography. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

Stoichiometry. (2)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Chemical Philosophy.—Cooke. (3)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.* — Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2)

Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

Blow-Pipe Analysis. — Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry. — Fresenius' Quantitative Analysis. (4) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Copper ore (Cu).
3. Silver coin (Au, Ag, Pb, Cu).
4. Zinc ore (Zn). By both gravimetric and volumetric methods.
5. Bronze (Cu, Sn, Zn, Pb).
6. Spiegeleisen (Mn).
7. Lead ore (PbS).
8. Ilmenite (TiO_2).
9. Iron ore (complete analysis).
10. Limestone (complete analysis).
11. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).

Steam Engine.—Holmes' Steam Engine. (3)

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Literature and History.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, platinum, mercury, tin, zinc, nickel, cobalt, arsenic, antimony, and bismuth. (5)

Blow-Pipe Analysis.—Practice. (1)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Mechanics of Machinery.—Herrmann-Smith. The graphical statics of mechanisms. (2)

Chemistry. — Quantitative analysis: laboratory work: Fresenius. (3) The following analyses are executed by the student:

12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).
15. Nickel ore (Ni, Co).
16. Gas analysis.

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Projects.—In metallurgy.

Gymnasium.

SECOND TERM.

Mining.—Mechanical preparation of ores. Coal washing. Callon. Lectures. (2) Prospecting. Economic geology. Boring. Valuation of property. Methods of mining. Lectures. Williams. (3)

Drawing.—Designing of furnaces and other metallurgical plant. (2)

Mechanics of Machinery.—Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

POST-GRADUATE YEAR.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Callon-André. Lectures. (4)

Geology.—General geological definitions and principles. Dynamic geology. Le Conte. (2)

Drawing.—General views of mining plant and detailed sketches. (2)

Surveying.—Mine survey. Theory and practice, with construction of mine maps. Tunneling and shaft location. (2)

Astronomy.—Young's General Astronomy. (3)

Surveying.—Triangulation. Leveling. Topographical surveys with transit and stadia. Topographical maps. (4)

SECOND TERM.

Mining.—Timbering and masonry. Support of excavations. Tunneling. Lectures. (2)

Geology.—Historic geology. Le Conte. (2)

Projects.—In geology and mining.

Surveying.—Geological survey: mapping and cross-sectioning. (2)

Drawing.—Designing of mining plant. (2)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map and estimate of cost. Lectures on construction and maintenance. (4)

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Preparation of Thesis.

THE SHORTER COURSE IN MINING.

This course is designed so that the student who desires to pursue the practice of mining and ore-dressing, and who does not wish to take the full course, may be prepared for

practice in four years, receiving the degree of Bachelor of Science in Mining (B.S.).

This course is identical with the preceding up to the end of the Freshman year.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Mining Technology.—Kinds and systems of timbering. Details of haulage and hoisting plant. Freehand, isometric, and detailed drawings. (7)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Geology.—General geological definitions and principles. Dynamic geology. Le Conte. (2)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Surveying.—Triangulation. Leveling. Topographical surveys with transit and stadia. Topographical maps. (4)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Geology.—Historic geology. Lectures. LeConte. Dana. (4)

Mining.—Prospecting. Economic geology. Boring. Valuation of property. System of mining. Lectures. Williams. (3) Timbering and walling. Support of excavations. Tunneling. Lectures. (2)

Steam Engine.—Holmes' Steam Engine. (3)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map. and estimate of cost. Lectures on construction and maintenance. (4)

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Literature and History.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Callon-André. Lectures. (4)

Graphical Statics.—Graphical analysis of roof-trusses and girders. (2)

Astronomy.—Young's General Astronomy. (3)

Surveying.—Mine survey. Theory and practice, with construction of mine maps. Tunneling and shaft location. (2)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Drawing.—General views of mining plant and detailed sketches. (2)

Gymnasium.

SECOND TERM.

Mining.—Mechanical preparation of ores. Coal washing. (2)

Projects.—In geology and mining. (1)

Drawing.—Designing of mining plant. (3)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Surveying.—Geological survey: mapping and cross-sectioning. (2)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

POST-GRADUATE YEAR.

Students who have completed the last course may obtain the degree of Engineer of Mines (E.M.) by one year's post-graduate work, though it is desired that all who intend taking that degree shall pursue the regular course, first given.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, platinum, mercury, zinc, etc. (5)

Blow-Pipe Analysis.—Practice. (1)

Chemistry.—Quantitative analysis: laboratory work: Fresenius. (3) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Copper ore (Cu).
3. Silver coin (Au, Ag, Pb, Cu).
4. Zinc ore (Zn). By both volumetric and gravimetric methods.
5. Bronze (Cu, Sn, Zn, Pb).
6. Spiegeleisen (Mn).
7. Lead ore (PbS).

Mechanics of Machinery.—Herrmann-Smith. The graphical statics of mechanisms. (2)

Chemical Philosophy.—Cooke. (3)

Drawing.—General views of metallurgical plant and detailed sketches. (2)

SECOND TERM.

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Chemistry.—Fresenius' Quantitative Analysis. (4) The following analyses are executed by the student:

8. Ilmenite (TiO_2).
9. Iron ore (complete analysis).
10. Limestone (complete analysis).

11. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).
12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).
15. Nickel ore (Ni, Co).
16. Gas analysis.

Drawing.—Designing of furnaces and other metallurgical plant. (2)

Projects.—In metallurgy.

Mechanics of Machinery.—Hoisting machinery, accumulalars, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Preparation of Thesis.

THE COURSE IN PHYSICS AND ELECTRICAL ENGINEERING.

In the arrangement of the details of this new course the object has been to provide for those who seek to fit themselves as Electrical Engineers a preliminary training as complete and broad as that given to the members of the other schools. The requirements for admission, the mathematical and English studies, the modern languages and other outside branches are the same as those in the other technical courses. To these have been added such portions of the Mechanical Engineering Course, with which this course is most closely allied, as are necessary to give the student a general but sufficiently accurate knowledge of machinery.

This preparation joined to the unusually full development of Physics—and especially of Electricity—will, it is thought, make a course sufficiently comprehensive and thorough for the proper training of candidates for this degree. The great success attending the large majority of the young men who have taken the one year's course in Electricity, in their subsequent electrical work, warrants the belief that this broader and more extended course will attain its object.

The main feature of this new course is the prominence given to the subject of Physics. This extends through three years, and while Electricity is specially developed the other branches, Elementary Mechanics, Heat and Light, are fully provided for. The opportunity is thus given to any one who wishes to acquire a more extensive knowledge of Physics than the University curriculum has heretofore offered. The student is well drilled in the theory by means of lectures and recitations, which carefully cover the whole subject, and he is required to go over the ground himself in the best of all schools—the working laboratory. Enough of work on each topic is given him to render him familiar with his subject. Much prominence is given to work that brings out the resources of the student himself, such as the construction of instruments and original investigation. He is encouraged to this and a regular portion of his time is set apart for this object.

It will be seen from the preceding statement that this course offers two great advantages: the thorough and extensive training of those intending to take part in the great development of Electric Science in the industrial field now going on and the facilities offered to those who wish to take a four years' course specially devoted to the whole branch of Physics.

The practical work of the Physical Laboratory is too extensive to allow of full details being given in the following arrangement of the course. The more important subjects developed may be mentioned here. In Mechanics, exact measurements, specific gravity, barometric leveling. In Heat, calorimetry and hygrometry. In Light, testing of optical instruments, spectroscopic analysis and photometry. In Magnetism, study of laws of force, determination of moments of magnets and of horizontal components of intensity of earth's magnetism in absolute units. In Meteorology, observations for several months as taken in the U. S. Signal Service stations, with all the usual corrections and reductions; construction of charts; mapping curves; reports, etc. In Electricity, management of batteries, con-

struction of instruments, electrical measurements, electrolysis and relation of electrical currents to heat and mechanical work; practical running and care and tests of dynamos for efficiency, etc.; electric lighting, with photometric tests of arc and incandescent lamps; measurement of heat units given off by lamps, their resistance (hot and cold); energy consumed in lamps; spectroscopic tests of purity of carbons; study of telegraph and telephone and of the application of electricity to railways; visits to manufactories, working systems, electric railways, etc.

In Magnetism, during the last year, attention has been given, both in lectures and in the laboratory work, to the investigation of the magnetic properties of iron, magnetic moment, intensity of magnetization, magnetic induction, permeability, susceptibility, hysteresis, etc. Both the ballistic and magnetometer methods are used. The study the magnetic circuit and the designing and calculation of a dynamo form part of the regular work of each student.

The degree of Electrical Engineer (E. E.) will be given to the graduates of this course.

FRESHMAN CLASS.

FIRST TERM.

See page 65.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (2)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Descriptive geometry and isometric drawing. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. Essays. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Laboratory Methods and Magnetism.—Lectures. (3)

Mechanics, Sound and Heat.—(Physical laboratory.) (4)

Drawing.—Plans of an electric light station. Architectural drawing. (2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Heat.—Continued. (Physical laboratory.)

Magnetism.—(Recitations and physical laboratory.) (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Steam Engine.—Holmes' Steam Engine. (3)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe,

Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Light.—Lectures.

Electricity and Magnetism.—Lectures with recitations; text-book, Slingo and Brooker's Electrical Engineering. (3)

Light and Electricity; Electrical Measurements.—(Physical laboratory.) (3)

Meteorology.—Text-book and practice. (1)

Strength of Materials.—Elasticity and strength of wood, stone and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Boilers.—Wilson. Strength, construction and wear and tear of boilers. (1)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Dynamic Machines and Electric Lighting; Magnetic Properties of Iron.—Text-books and lectures. Slingo and Brooker. (3)

Electrical Measurements, Spectroscopic and Photometric Work; Magnetic Properties of Iron, Magnetic Induction, Intensity of Magnetization, Permeability, Hysteresis.—(Physical laboratory.) (5)

French.—Readings. Compositions. Lectures on French Literature. (2) Or *German.*—Readings. Compositions. Lectures on German Literature. (2)

Machine Design.—Calculations for a High-Speed Steam Engine. Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods. (5)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Theory of Dynamic Machines.—Electro-magnets, Thompson. Dynamo construction. Text-book and lectures. (2)

Dynamic Machines. — Practice in running and care of. Tests of efficiency in generators and motors, photometric and spectroscopic tests of lamps, etc. (Physical laboratory.) (5)

Machine Design.—Proportioning of Machine Parts (continued). (2)

Astronomy.—Young's General Astronomy. (3)

Mechanics of Machinery.—Herrman-Smith. The graphical statics of mechanisms. (2)

Scientific Readings.

Gymnasium.

SECOND TERM.

Applications of Electricity to Railways, etc. (4)

Measurement of Power. — Indicating of Steam Engines; dynamometer experiments. (1)

Physics.—Original Investigation. (5)

Lectures on English and American Literature. (2)

Christian Evidences. (1)

Preparation of Thesis.—(With laboratory work.)

Gymnasium.

THE COURSE IN CHEMISTRY.

This course of study is designed to prepare students for the profession of the chemist, in connection with metallurgical establishments, sugar refineries, gas works, superphosphate works, electrical machinery manufactories, mining companies, etc., and the general consulting and analytical work of the professional chemist. It is also well adapted for the preparation of teachers of chemistry and as a preliminary course to the study of medicine. It is eminently practical, the student's time being largely occupied by practical work in the large, well equipped and well ventilated chemical laboratories, which were completed in 1885 and constitute the best constructed building for this purpose in this country. The museum of chemistry contains large collections of specimens, for illustrating the lectures on theoretical and applied chemistry.

THEORETICAL CHEMISTRY.—Instruction in this subject begins with lectures four times a week, in the first term of the Freshman year. These lectures are fully illustrated by experiments, colored diagrams, working drawings and lantern pictures, and specimens from the museum. They include a general introduction to theoretical chemistry, and a description of the non-metallic and metallic elements and their compounds, the general subject of inorganic chemistry. The students are required to take notes of the lectures, and to pass a written examination at the end of the term.

In the second term of this year stoichiometry and chemical problems and reactions are taught by recitations twice each week.

The study of theoretical chemistry is continued throughout the Sophomore year by recitations three times a week from Cooke's Chemical Philosophy and Remsen's Chemistry and is concluded in the first term of Junior, by a course of lectures and recitations on theoretical organic chemistry, four times a week. These lectures are illustrated by experiments and by specimens from the museum of chemistry.

Written examinations are held at the close of each of the above courses.

ANALYTICAL CHEMISTRY.—Qualitative analysis is taught in the second term of the Freshman year, by lectures, recitations, and practical work in the qualitative laboratory, twelve hours of practical work per week being required. This laboratory is a large, well ventilated, and well lighted room, supplied with convenient working tables, vacuum filtration, hoods for noxious vapors, steam baths, gas and washing appliances, and a commodious room for hydrosulphuric acid. Distilled water is delivered by faucet in this room and the other large laboratories. At the close of the term a practical examination is held in this subject.

After completing this course, quantitative analysis is pursued throughout the Sophomore and the first term of

the Junior years. This subject is taught by lectures, recitations, and practical work in the quantitative laboratory, which is equipped similarly to the qualitative laboratory, but is supplied in addition with apparatus for drying precipitates and residues, rooms for the chemical balances, for combustions, and for a reference library.

Twelve hours per week are required during the first term of the Sophomore year and fifteen hours during the second term of that year and the first term of the Junior year.

The course consists in gravimetric and volumetric analyses, as applied to the substances given in the lists farther on, accuracy being required in the determination of each constituent.

At the close of each term written examinations are held upon the theory and practice of quantitative analysis.

Gas Analysis is taught by lectures and laboratory practice in the gas laboratory. This laboratory is supplied with full and complete apparatus for gas analysis, according to Bunsen's processes, as well as apparatus for some of the more rapid methods. Mixtures of gases are required to be analyzed by the students, within certain limits of error, and a written examination, on the theory and practice, is held at the close of the course.

Assaying.—The assaying of ores by furnace assay, together with gold and silver bullion analysis, by processes practiced in the United States Mint, is taught by lectures and practical work in the first term of the Senior year, nine hours of practical work per week being required. The course includes the assaying of ores of lead, tin, antimony, gold, silver, and iron, coal, and gold and silver bullion.

The assaying laboratory is supplied with large working tables, twenty-nine crucible and two iron furnaces, and eight muffle furnaces, with adjoining rooms for balances, and gold and silver bullion analysis.

A certain accuracy of results and a written examination as regards theory and practice are required.

ORGANIC CHEMISTRY.—The practical work in this subject is performed in the second term of the Junior year, eighteen hours per week being required, with conferences and recitations each week. The laboratory for this work is equipped similarly to the quantitative laboratory, in addition being supplied with steam heat, cold water and air blast upon the working tables, and a full supply of apparatus for the various determinations and experiments, including combustion furnaces, furnaces for heating sealed tubes, mercury pump, Hoffman's, Dumas' and Meyers' apparatus for vapor densities, nitrometers, chemical balances, etc.

The course consists of determinations of specific gravities, melting points, boiling points, vapor densities, chlorine, bromine, iodine, and sulphur of organic substances.

Combustion analysis, nitrogen determination, fractional distillation, and the preparation of several pure organic compounds and their analysis are included.

INDUSTRIAL CHEMISTRY.—A course of lectures is delivered upon this subject in the second term of the Senior year, illustrated by experiments, diagrams, lantern pictures, and specimens from the museum of chemistry. The working laboratories for this subject contain an apparatus for making illuminating gas, an alcohol still, worm and doubler, and a complete working model of a sugar refinery, including filters, vacuum pan, and centrifugal. There is also apparatus for use in the manufacture of chemicals, for dyeing, calico printing, and bleaching. In connection with these laboratories is a room containing a photometer and apparatus for determining the sulphur, ammonia, and specific gravity of illuminating gas; also a laboratory for the testing of alcoholic liquors, sugar, molasses, bone black, soap, petroleum, paints, dyes, superphosphates, and other commercial products, with the necessary technical apparatus. The students make practical experiments in this direction, and, with an instructor, visit various industrial establishments in this neighborhood and in and around New York City.

TOXICOLOGY.—A course of lectures on this subject is given in the first term of the Junior year, illustrated by experiments and by the large collection of specimens of poisons from the museum of chemistry. This is supplemented by a short course of laboratory work on some of the common poisons.

SANITARY CHEMISTRY.—During the second term of the Senior year attention is given to the qualitative and quantitative examination of air, water, food, disinfectants, and other subjects connected with this branch of the science. Special apparatus is provided for this work, as recommended by the best authorities on the subject.

PHOTOGRAPHIC CHEMISTRY.—A well equipped photographic laboratory and dark rooms are provided, in which the students of the chemical course receive practical instruction.

PHYSIOLOGICAL CHEMISTRY.—The examination of urine, blood, etc., receives a proper amount of attention.

The course also includes instruction in physics, mineralogy, blowpipe analysis, metallurgy, and geology, which are of great value to the chemist.

MICROSCOPY.—Instruction in the use of the microscope is given in the first term of the Senior year.

In the Senior year the student is required to prepare a thesis on some subject, selected by the Professor of Chemistry, involving practical work in the laboratory in addition to the literary labor, each graduate thus making a contribution to the progress of the science, as a preliminary to the reception of his degree.

The graduate of this course receives the degree of Analytical Chemist (A.C.).

Students, not candidates for a degree, are admitted for special courses in chemistry, of which they will receive certificates.

The laboratories are under the immediate charge of the Professor and Instructors of Chemistry and are open to the students from 8 o'clock A.M. to 6 o'clock P.M., including

Saturdays. Students are at liberty to work in the laboratories beyond the required hours as their time may permit. Students are charged for materials and apparatus consumed; with moderate care this expense need not exceed $50 per year.

FRESHMAN CLASS.

FIRST TERM.

See page 65.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

French.—Grammar and Reader (continued). (3) Or *German.*—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Stoichiometry. (2)

English.—Rhetoric. Essays. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Chemical Philosophy.—Cooke. (3)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (4)

The following analyses are executed by the student:

1. Iron wire (Fe).
2. Potassium dichromate (Cr_2O_3).
3. Barium chloride (Ba, Cl, H_2O).
4. Magnesium sulphate (MgO, SO_3, H_2O).
5. Disodium hydrogen phosphate (P_2O_5).
6. Rochelle salt (K_2O, Na_2O).
7. Volumetric determination of chlorine.
8. Acidimetry (HCl, H_2SO_4, HNO_3, $HC_2H_3O_2$).
9. Alkalimetry (KOH, NaOH, NH_4OH, soda ash, pearl ash).

10. Chlorimetry (bleaching powders).

Quantitative Analysis.—Conference. (1)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

SECOND TERM.

Physics.—Sound and light. Lectures and recitations. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

11. Copper ore (Cu).
12. Zinc ore (Zn). By both gravimetric and volumetric Methods.
13. Lead ore (Pb, S).
14. Silver coin (Au, Pb, Ag, Cu).
15. Spiegeleisen (Mn).
16. Copper alloys (complete analysis).
17. Ilmenite (TiO_2).
18. Iron ore (complete analysis).
19. Limestone (complete analysis).
20. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).
21. Slag (complete analysis).

Quantitative Analysis.—Conference. (1)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemical Philosophy. (3)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Toxicology.—Lectures. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

22. Guano (NH_3, P_2O_5, H_2O).
23. Clay (complete analysis).
24. Manganese ore (MnO_2).
25. Mineral water (complete analysis).
26. Pig iron (complete analysis).
27. Nickel ore (Ni, Co).
28. Carbon in steel (volumetric).
29. Gas analysis.

Quantitative Analysis.—Conference. (1)

Organic Chemistry.—Lectures and recitations. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Organic Chemistry.—Laboratory. (6)

Organic Chemistry—Conference. (1)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. E. S. Dana. (3)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, platinum, mercury, tin, zinc, nickel, cobalt, arsenic, antimony and bismuth. (5)

Assaying.—Including the assay by the dry method of gold, silver, antimony, lead, iron, and tin ores, coal, gold and silver bullion, and rich lead. Ricketts. (3)

Industrial Chemistry.—Laboratory. (3)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Microscopy.—Laboratory. (2).

Preparation of Thesis.

Gymnasium.

SECOND TERM.

Industrial Chemistry.—Lectures. (3)

Industrial Chemistry.—Laboratory. (3)

Industrial Chemistry.—Conference. (1)

Agricultural Chemistry.—Laboratory. (1)

Sanitary Chemistry.—Laboratory. (1)

Geology.—Historic and dynamic geology. Lectures. Geikie. (2)

Christian Evidences.—Lectures. (1)

Lectures on American and English Literature. (2)

Preparation of Thesis. (2)

Gymnasium.

THE COURSE IN ARCHITECTURE.

The studies in this course are closely allied with those in civil engineering, the higher surveying, railroad work, mineralogy, geology, and astronomy being omitted, instead of which architectural drawing and designing is substituted as seen in the following program. Instruction is also given in the history and æsthetics of architecture, in methods of heating and ventilating, in boilers and hoisting machinery, and in house drainage and sewerage.

During the first and second years the student lays the foundation for his professional work by the study of mathematics, physics, mechanics, drawing, surveying, English, and French or German. The course in drawing includes the use of water colors, free-hand, projection and isometric drawing, and their application to the general plans for a small building. In surveying there is field practice in the use of instruments, and also map drawing, thus enabling the student to understand the application of the subject to landscape gardening, and to the location of buildings.

During the third and fourth years of the course the work is of a more professional character. The subject of construction familiarizes the student with brick, stone, cement, and other materials, with foundations and masonry, with arches, piers, and walls, and with the stone-cutter's art. There is a full course in the theory and calculation of columns, beams, and shafts, in the strength of materials and its application to roof trusses and bridges. Working drawings of arches, piers, and roof trusses are made in detail. Plans and estimates are prepared for wooden, brick, stone, and iron buildings, the work being done according to standard specifications. In connection with the course visits of inspection are made to the numerous engineering structures in the Lehigh Valley and vicinity.

The student who completes all the subjects of this course will receive the degree of Bachelor of Science in Architecture (B. S.).

FRESHMAN CLASS.

FIRST TERM.

See Page 65.

SECOND TERM.

Mathematics.— Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Surveying.— Theory of chain and compass surveying. Computation of areas. Elements of leveling. (1)

French.—Grammar and Reader (continued). (3) Or *German.*—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Descriptive geometry and isometric drawing. Tracings. Warren's Elementary Projection Drawing. (4)

English.—Rhetoric. Essays. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—Architectural drawing. Plans of piers and arches. (2)

Surveying.—Use of compass, level, and transit. Surveys and maps of farms. Colored topography. (2)

English.—Essays. Readings in English classics. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and light. Lectures and recitations. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Surveying.—Profiles and contour maps. Hydrographic and city surveying. Use of the plane table. Topographical drawing and sketching. (3)

English.—Essays. Readings in English classics. (1)

Gymnasium.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus, and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams. columns, and shafts, Reports on the testing of materials. (4)

Construction.—Materials of construction. Masonry. Foundations. Theory of retaining walls and arches. (2)

Drawing.—Shades, shadows, and linear perspective. Sketches and designs for ornaments and simple details. (6)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Roofs and Bridges.—Theory and calculation of strains in roof and bridge trusses. Graphical statics. (4)

Construction.—Stone cutting, with working drawings. (3)

Architecture.—Designs and estimates for brick and stone buildings. (4)

History.—The history and styles of architecture. (3)

Literature and History. (1)

Gymnasium. (2)

SENIOR YEAR.

FIRST TERM.

Roofs and Bridges.—Cantilever, suspension, and arch bridges. Designs for plate girders and riveted roof trusses. (6)

Mechanics of Machinery.—Pile drivers, cranes, and elevators. (2)

Boilers.—Strength, construction, and wear and tear of boilers. Wilson. (1)

Architecture.—Specifications and estimates. Design for an iron building. (5)

Heating and Ventilation.—Systems of heating, lighting, and ventilating buildings. (2)

Gymnasium.

SECOND TERM.

Hydraulics.—Efflux of water from orifices, and flow in pipes and channels. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Sanitary Engineering.—Collection, purification, and distribution of water. Systems of water supply. The combined and the separate system of sewerage. Drainage and sewerage of buildings. (4)

Roofs and Bridges.—Design for a pin-connected roof truss, with working drawings. (3)

Architecture.—Building superintendence. The æsthetics of architecture. Original plans, estimates, and specifications. (4)

Lectures on English and American Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

PHYSICAL CULTURE.

The Gymnasium is open morning, afternoon and evening, in all, 45 hours a week. Exercise in it is required of all students who are fitted to take it. Class drill with the Instructor and individual exercise are prescribed.

GRADUATING THESES.

Every student will be required to present a thesis upon some topic connected with his special course, as a necessary portion of the exercises for his final examination for a

diploma. These theses shall be accompanied by drawings and diagrams, when the subjects need such illustration. The originals will be kept by the University, as a part of the student's record, for future reference; but a copy may be retained by the student, and be published, permission being first obtained from the President.

DIPLOMAS AND CERTIFICATES.

The Diploma is given only to those who have passed all the examinations in a regular course and is signed by the Secretary of the Board of Trustees and by the Faculty of the University. For all the partial courses a certificate is given, signed by the Secretary of the Faculty, and showing what the student has accomplished.

GRADUATE STUDENTS.

Graduate students wishing to remain a year or more and pursue a course of study as candidates for another Degree may do so with the sanction of the Faculty. Those wishing to take *special* courses of study will be afforded every facility for so doing.

POST-GRADUATE DEGREES.

M. A.

The Faculty will recommend for the Degree of Master of Arts any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Arts, shall pursue, for at least one year at this University, or two years elsewhere, a course of liberal study prescribed by the Faculty in at least two departments, (under at least two professors), pass a thorough examination in the same and present a satisfactory Thesis.

M. S.

The Faculty will recommend for the Degree of Master of Science any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Science, or any Degree in the School of Technology, shall

pursue, for at least one year at this University, or two years elsewhere, a course of study prescribed by the Faculty in at least two departments, (under at least two professors), pass a thorough examination in the same and present a satisfactory Thesis.

Ph. D.

The Faculty will recommend for the Degree of Doctor of Philosophy any candidate, otherwise properly qualified, who, after taking at this University the Degree of Master of Arts or Master of Science, shall pursue, for at least one year at this University, a course of advanced study prescribed by the Faculty, in at least two departments, (under at least two professors), pass a thorough examination in the presence of the Faculty in the same and present a satisfactory Thesis giving evidence of original investigation.

The candidate shall have a good knowledge of Latin and either French or German.

The Theses presented by candidates for Post-Graduate Degrees shall be retained by the University.

Applicants for any of these degrees will be required to complete the prescribed work within the allotted time. Special action of the Faculty is required for any extension of time.

THE UNIVERSITY LIBRARY.

The Library building was erected by the Founder of the University in 1877, at a cost of $100,000, as a memorial of his daughter, Mrs. Lucy Packer Linderman, and during the same year more than $20,000 were contributed by her family and friends as a memorial fund for the purchase of books. By the will of the Founder of the University a fund of $500,000 has been given for the permanent endowment of the library.

The building is semi-circular in plan, with a handsome façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior, the center is occupied as a reading space,

fifty by forty feet, from which radiate the book cases, extending from floor to ceiling; two galleries affording access to the upper cases. Shelf room is now provided for one hundred and sixty thousand volumes. The building is thoroughly fireproof, well lighted, and heated by steam.

Ninety thousand volumes are now upon the shelves, including many extremely valuable works. The list of periodicals numbers about two hundred and fifty, embracing as far as possible all departments of knowledge.

The Library is conducted strictly for consultation, and is open to the use of the public; both of which conditions are in accord with the terms of the gift.

REGULATIONS OF THE LEHIGH UNIVERSITY LIBRARY.

I. The Library is open every day, except Sundays and Legal Holidays, from 8 A.M. until 10 P.M., and on Sundays for the students and others connected with the University from 1.30 P.M. until 9.30 P.M.

II. Admission is free to all persons over 16 years of age.

III. Readers are required to write their names and addresses in the Daily Register of the Library. They also write the name of the book desired upon a Library Card, with their signatures, and present the same to the Director's Clerk, who supplies the book, retaining the card as a receipt. Before leaving the Library, readers return their books to the clerk, and receive their cards.

IV. The University Professors and Instructors, only, are allowed to take books from the Library Building.

V. No person is allowed to enter the alcoves, or remove any book from the shelves, without permission of the Director.

VI. Readers wishing to consult the more valuable illustrated works make special application for that purpose.

VII. In taking notes, pencils, and not pens and ink, are to be used.

VIII. Audible conversation and the use of tobacco are strictly forbidden in any part of the Library.

IX. Any person not conforming to these Regulations will be denied the privilege of the Library.

X. Any person who defaces, in any way, any book, magazine or paper, or the furniture, or any portion of the building, in addition to being deprived of the privileges of the Library will be prosecuted according to law.

OBSERVATORY.

By the liberality of Robert H. Sayre, Esq., one of the Trustees of the University, an astronomical observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

In the dome of the observatory is mounted an equatorial telescope, of six inches aperture, by Alvin Clark & Sons. The west wing contains a superior sidereal clock, by Wm. Bond & Sons; a zenith telescope, by Blunt, and a field transit, by Stackpole. There is also a prismatic sextant, by Pistor & Martins.

Students in practical astronomy receive instruction in the use of the instruments and in actual observation.

The grounds upon which the Observatory stands, consisting of seven acres of land adjoining the original grant, were presented to the University by Charles Brodhead, Esq., of Bethlehem.

THE PACKER MEMORIAL CHURCH

is the recent and munificent gift of Mrs. Mary Packer Cummings, daughter of the Founder of the University. It is a large and magnificent Church, richly furnished and handsomely appointed in every particular. There is no more beautiful Church edifice in the State and it is one of the noblest in all the land.

THE UNIVERSITY MUSEUM.

In addition to the large collection illustrating all branches of Industrial Chemistry, the Museum includes collections in Metallurgy, Geology, Zoölogy, and Archæology.

The Metallurgical Cabinet already includes specimens illustrating the various processes for obtaining the more common metals.

The Zoölogical Cabinet includes the Werner collection of nearly all the types of American birds with their nests and eggs, and the Packer collection of recent shells.

The Geological Cabinet numbers over ten thousand specimens and includes the Palæontological, Mineralogical, Petrographic, and Economic collections. The first contains good specimens of nearly all the common genera. The Mineralogical division includes the Keim and Rœpper collections—the latter being especially complete and valuable from a crystallographic standpoint. The Petrographic division numbers several thousand specimens and, besides including numerous varieties of nearly all the rocks of the globe, contains a duplicate set from the collection of the Second Geological Survey of this State. The Economic division was formed and donated by Dr. James P. Kimball, Director of the Mint, and formerly Professor of Economic Geology.

The Cummings Archæological Cabinet numbers three thousand specimens and includes Dr. Stubbs' collection of Indian relics, weapons, and utensils.

SUMMER SCHOOL OF SURVEYING.

A Summer School of Surveying, extending over a period of five or six weeks, is held during the long vacation, provided that the attendance of at least twelve students is assured. In 1893 the school will open on August 1 at Hazleton, Pa., or at some other place in the anthracite coal region. Applications to join it should be made to the President before June 1, 1893.

Students of the University who have completed the surveying work of the Sophomore year, and other persons who present satisfactory evidence of having a good knowledge of algebra, trigonometry, and land surveying, and of having had some practice with the transit and level, may

be admitted to the Summer school. The tuition fee is $25, payable in advance.

The work of the Summer school is under the direction of the Professor of Civil Engineering. Instruction is given by lectures or text-books in the theory of instruments, their care and adjustments, in the best processes for topographical work, in geodesy, and in the method of least squares. The field work includes base line measurements, topography by stadia, plane table, and other methods, leveling, sketching, and all the operations of a complete topographical survey. The office work comprises the computations necessary for the reduction of the field notes, including the adjustment of the triangulation, practice in topographical drawing, and the preparation of a finished map of the territory covered by the survey. One day in each week will be devoted to visits of inspection to mines, quarries, bridges, and engineering works in Eastern Pennsylvania.

At the close of the session of the Summer school, examinations are held covering its entire course of theory and practice. Students of the University holding certificates of having completed the work of the school are not required to take the regular courses in surveying given in the Civil Engineering department during the first term of the Junior year, and the first term of the Senior year.

THE CHEMICAL AND NATURAL HISTORY SOCIETY OF THE LEHIGH UNIVERSITY.

This Society was organized in the Fall of 1871, as "The Chemical Society," but was afterwards expanded, as its present title indicates, and admits, by election, students from all departments of the University.

The collections of botanical and zoölogical specimens belonging to the Society are already important. During the past years persons have been sent to Texas and Brazil to collect specimens for these cabinets.

The Society has organized and maintained several courses of public scientific lectures.

Among the honorary members of the Society are more than one hundred of the most distinguished scientists in Europe and the United States.

THE ENGINEERING SOCIETY.

This Society was organized in 1873, and admits, by election, students in the Junior and Senior Classes. Its meetings are held fortnightly. At these, papers relating to engineering subjects are read and discussed. It has issued quarterly five volumes of "The Journal of the Engineering Society," containing contributions by the members, alumni, and others.

THE MINING CLUB.

This was organized in 1883 and takes from the Junior, Senior, and Post-Senior Classes those members of the Mining School who excel in their studies or in practical experience in the subjects of the course.

THE ELECTRICAL ENGINEERING SOCIETY.

was organized in November, 1887, by students in the Advanced Course in Electricity. Its object is to supplement the regular work of the department by the study and discussion of electrical subjects.

THE AGORA

is a literary society which meets semi-monthly. Only students in the School of General Literature are eligible to membership.

THE ATHENÆUM

is also a literary society, whose active membership is confined to the Sophomore Class. The meetings are held weekly.

THE CLASSICAL CLUB.

This organization was founded in the Spring of 1889, and consists of the students in the Classical and Latin-Scientific Courses, together with those members of the Faculty who are interested in this department of learning. At its monthly meetings, papers upon philological, historical, and archæological subjects are read by students belonging to the upper classes, and are then discussed and criticised. Thus independent work is encouraged and correct methods of investigation are acquired. This is especially valuable for those men who purpose becoming teachers or original investigators. Reports upon new discoveries and reviews of recent books vary the proceedings and keep the members informed in regard to the advances of philological science.

THE NATURAL SCIENCE CLUB OF THE LEHIGH UNIVERSITY.

The object of this organization is systematic study, in connection with field work, in natural history and its associated subjects. Its members are engaged in making a survey, both botanical and mineralogical, of the region within a radius of five miles from the University and propose to collect an herbarium and mineralogical cabinet which shall contain specimens of all the plants and minerals within this district.

THE LEHIGH UNIVERSITY CHRISTIAN ASSOCIATION.

This is a voluntary organization of the students for the promotion of the religious, moral, and social life in the University. It was organized April 18, 1890, and on Oct. 11, 1890, united itself with the Intercollegiate Young Men's Christian Association. The movement is distinctly for and by students, all the officers being chosen from the student body. Those connected with Evangelical churches of whatever creed are eligible to *active membership; associate*

membership may be claimed by men of good moral standing who are not members of churches. The association is continually growing, and is extending a marked influence for good among the men.

THE BIBLE CLASS.

A class for the reverent study of the sacred Scriptures, under the direction of the Chaplain, meets every Sunday afternoon at half past three o'clock. This class aims at both practical and theoretical results—the edification of its members in the Word of God, and the application of the (so-called) "scientific" or "historical" method to the study of Holy Writ.

FOUNDER'S DAY.

On the second Thursday of October of each year, Commemorative Exercises are held in honor of the Founder of the University.

UNIVERSITY SERMON.

This sermon is preached on the Sunday before University Day.

The Rev. Otis A. Glazebrook, D.D., of Elizabeth, N. J., was the preacher on Sunday, June 12, 1892, in the Memorial Church.

THESES.

Theses on the following subjects were prepared by the graduating class of 1892:

FOR THE DEGREE OF E.M.

"The system of under-ground rope haulage at Park Place."

HERMAN VICTOR HESSE, B.S.

FOR THE DEGREE OF B.A.

"The Early English Novel."

WILLIAM NORTH ROBINS ASHMEAD.

"Persius."

JOHN ADAMS GRUVER.

FOR THE DEGREE OF C.E.

"A toggle-joint pile driver."

GEORGE WILLIAM BALLOCK ASMUSSEN.

"Review of the hinged arch over Thirtieth Street, Philadelphia."

ROBERT LIGGET BAIRD.

"Design for a highway bridge over the Susquehanna river at Sunbury, Pa.

JOHN NEWBAKER BASTRESS.

"The pumping system of Short Mountain Colliery."

OTTO CORNELIUS BURKHARDT, E.M.

"The utilization of the water power of the Lehigh river."

PHILIP LOTHROP COBB.

"Cement testing, and the manufacture of Portland cement."

FREDERICK ALBERT COLEMAN.

"The strength and testing of materials under suddenly applied stresses and shocks."

WILLIAM RUSSEL DAVIS.

"Steel tapes as applied to base-line measurement."

THANLOW GJERTSEN.

"Design for a draw-bridge of 250 feet span."

JUAN JOSÉ JIMENEZ.

"Review of two railway lattice girders."

SYLVESTER WELCH LABROT.

"Plan for strengthening the New Street bridge, so as to allow the passage of electric cars."

EDWARD JAMES MILLAR.

"Plans and specifications for a locomotive round-house at South Bethlehem."

ROBERT BLUM OLNEY.

"Design of a gas-holder and casing."

ROBERT SWENK RATHBUN.

"The question of sewage disposal in South Bethlehem."

JOHN IRA RIEGEL.

"A discussion of the Pennsylvania Railroad train-shed at Jersey City, N. J.

ANTON SCHNEIDER.

"The West Virginia Central and Pittsburgh Railroad."

JAMES CAUSTEN SHRIVER.

"Review of the water supply of Lebanon, Pa."

DAVID HEIKES WITMER.

"Investigation of stresses in a locomotive turn-table."

BYRON EDGAR WOODCOCK.

FOR THE DEGREE OF M.E.

"Locomotive brakes."

JOHN MAYALL BEAUMONT.

"The design of a five-horse power electric motor."

SAMUEL DEWEY CUSHING.

"Discussion of experiments in aërodynamics."

HERMAN HAUPT DAVIS.

"Transmission of power by belts and ropes,"

PERCIVAL DRAYTON.

"The compound locomotive."

WILLIAM LAWALL JACOBY.

"Pumping and selection of a suitable pump for the S. G. & W. Co.'s plant."

ROBERT REED KITCHEL.

"Efficiency of a one-ton triplex spur-gear block."

ALFRED EMORY LISTER.

"Automatic couplers, with the cost of placing them on the Lehigh Valley Railroad.

FRANK DE WITT RANDOLPH.

"Design of a machine shop for building high-speed engines."

CASS KNIGHT SHELBY.

"Plans for, and estimate of cost of fitting up a forty-barrel flouring mill."

CHARLES OAKS WOOD.

FOR THE DEGREE OF B.S.

(IN METALLURGY.)

"A description of the Bessemer process, as employed by The Bethlehem Iron Company."

JOSEPH BARRELL.

"The heat distribution in furnace No. 6 of The Bethlehem Iron Company."

JOHN YOUNG BASSELL, Jr.

"A review of the metallurgical plant for the reduction of lead and silver ores at Great Falls, Montana."

CHARLES MERRITT CASE.

"The Barr contracting chill for railway car-wheels."

GEORGE PRICE CASE.

"A review of magnetic concentration, with special reference to the conditions existing at Benson Mines, St. Lawrence Co., N. Y."

EDWIN DODGE.

"Investigations upon commercial aluminium."

GEORGE WASHINGTON ENGEL.

"A treatise on the properties, manufacture, and use of nickel steel."

ALFRED EMERSON JESSUP.

"On the methods employed in the erection of a ten-stamp sectional gold mill, as used in the Darien gold district, Republic of Colombia."

HENRY LEFEVRE.

"A comparison of some regenerative hot-blast stoves."

RAMON ECKHARDT OZIAS.

FOR THE DEGREE OF B.S.

(IN MINING.)

"A proposed scheme for clarifying waste water."

MORGAN DAVIS.

"Methods of survey for slopes of great dip."

HEBER DENMAN.

"Review of the Centralia drainage tunnel."
HENRY LEWIS MANLEY.

"Design for an iron head-frame."
HENRY ORTH, JR.

FOR THE DEGREE OF E E.

"An experimental study of the working conditions of the electric railway motor."
WILLIAM WILLIAMS BLUNT.

"Magnetic leakage in the Thomson-Houston and Westinghouse dynamos and Edison motor."
WILLIAM JOHN LLOYD.

"Hysteresis."
JOHN TAYLOR LOOMIS.

"Plans and specifications for an electric railway in South Bethlehem, Pa."
RAYMOND MASSON.

"Magnetic leakage in the Edison dynamo."
CHARLES TYLER MOSMAN.

"The opened magnetic circuit transformer."
SAMUEL ARTHUR RHODES.

"Design for a conduit electric road."
PHILIP HENRY SMITH.

"Investigation of the absorption of power by the different styles of motors on the Savannah Electric Railway."
MICHAEL NELIGAN USINA.

"Plans and estimates for an electric lighting plant for North Platte, Nebraska.
LESTER WARREN WALKER.

FOR THE DEGREE OF A.C.

"Description and working of a blast furnace."
HARRY S. ECKERT.

"Weathered and unweathered coals."
LESTER HALLETT ELY.

"History of the theory of chemistry."
HERMAN EUGENE KIEFER.

"The mineral paint works at Bethlehem, Pa.
JOHN BONNER SEMPLE.

"Comparison of the rapid and standard methods for the elements Li, P, S, Fe, in iron and its ores."
FREDERIC WITTMAN.

FOR THE DEGREE OF B.S.

(IN ARCHITECTURE.)

"Art, architecture and engineering."
WILLIAM YOUNG BRADY.

UNIVERSITY DAY.

This day is the last of the academic year and falls in 1893 on the third Wednesday in June. On this day orations are delivered by members of the graduating class, and degrees are conferred.

EXERCISES ON JUNE 15, 1892.

Reading of Scripture and Prayer by the Rev. Elwood Worcester, Ph.D., Chaplain of the University.

Salutatory Oration.—"The Fall of Constantinople."
WILLIAM NORTH ROBINS ASHMEAD.

Oration.—"The American Type of Manhood."
ROBERT LIGGET BAIRD.

Oration.—"Immigration."
JOHN NEWBAKER BASTRESS.

Valedictory Oration.
WILLIAM RUSSEL DAVIS.

Award of the Wilbur Scholarship to
JULIUS LEDERER NEUFELD,
of Philadelphia, first in rank in Sophomore Class.

The Wilbur Prizes were awarded as follows:

Freshman Class, Mathematics, to
HARRY WILBER BEACH, of Montrose.
WALTER FERRIS, of Jennersville.

Freshman Class, French, to
JOHN EGBERT SHERO, of Fredonia, N. Y.

Freshman Class, German, to
WILLIAM REINECKE, of Louisville, Ky.

Freshman Class, Themes, to
JOHN EUGENE STOCKER, of Bethlehem.

Freshman Class, Rhetoric, to
CHARLES HENRY VANSANT, of Eddington.

Freshman Class, Freehand Drawing, to
WARREN BYRON KEIM, of Reading.

The following degrees were conferred:

E. M.

HERMAN VICTOR HESSE, B.S.

B. A.

WILLIAM NORTH ROBINS ASHMEAD,
JOHN ADAMS GRUVER.

C. E.

GEORGE W. B. ASMUSSEN,
ROBERT LIGGET BAIRD,
JOHN NEWBAKER BASTRESS,
OTTO CORNELIUS BURKHARDT,
PHILIP LOTHROP COBB,
FREDERICK ALBERT COLEMAN,
WILLIAM RUSSEL DAVIS,
THANLOW GJERTSEN,
JUAN JOSE JIMENEZ,

SYLVESTER WELCH LABROT,
EDWARD JAMES MILLAR,
ROBERT BLUM OLNEY,
ROBERT SWENK RATHBUN,
JOHN IRA RIEGEL,
ANTON SCHNEIDER,
JAMES CAUSTEN SHRIVER,
DAVID HEIKES WITMER.

M. E.

JOHN MAYALL BEAUMONT,
SAMUEL DEWEY CUSHING,
HERMAN HAUPT DAVIS,
PERCIVAL DRAYTON,
WILLIAM LAWALL JACOBY,
ROBERT REED KITCHEL,
AFRED EMORY LISTER,
FRANK DEWITT RANDOLPH,
CASS KNIGHT SHELBY,
CHARLES OAKS WOOD.

B. S.
(In Metallurgy.)

JOSEPH BARRELL,
JOHN YOUNG BASSELL, JR.,
CHARLES MERRITT CASE,
GEORGE PRICE CASE,
RAMON ECKHART OZIAS,
ALFRED EMERSON JESSUP,
EDWIN DODGE,
GEORGE WASHINGTON ENGEL,
HENRY LEFEVRE.

B. S.
(In Mining.)

MORGAN DAVIS,
HEBER DENMAN,
HENRY LEWIS MANLEY,
HENRY ORTH, JR.

E. E.

WILLIAM WILLIAMS BLUNT,
WILLIAM JOHN LLOYD,
JOHN TAYLOR LOOMIS,
RAYMOND MASSON,
CHARLES TYLER MOSMAN,
SAMUEL ARTHUR RHODES,
PHILIP HENRY SMITH,
MICHAEL NELIGAN USINA,
LESTER WARREN WALKER.

A. C.

HARRY S. ECKERT,
LESTER HALLETT ELY,
HERMAN EUGENE KIEFER,
JOHN BONNER SEMPLE,
FREDERIC WITTMAN.

B. S.

(In Architecture.)

WILLIAM YOUNG BRADY.

THE WILBUR SCHOLARSHIP.

This Scholarship was founded in 1872 by E. P. Wilbur, Esq., of South Bethlehem, and is the sum of $200 awarded annually to the student in the Sophomore Class having the best record.

THE ALUMNI SCHOLARSHIP.

The Alumni Association of the University has established a Scholarship of the value of $250 per annum, subject to the following conditions:

1. That the Scholarship shall only be awarded to a student in need of it.

2. That the Scholarship shall not apply to the first year of any student's course; he must without this aid have gone through one year, and must be prepared to start the second year free from all conditions.

3. That the Scholarship shall not be continued to a student who shall at any time during his course carry any condition over eight weeks beyond the date of the examination in which he failed.

Subject only to the above conditions the disposal of the fund shall until otherwise directed be in the hands of the President of the University.

THE HENRY S. HAINES MEMORIAL SCHOLARSHIP.

Mrs. Henry S. Haines, of Savannah, Ga., has established a scholarship of the annual value of $200, which is to be devoted to the support at the Lehigh University, throughout his scholastic career, of one student in the School of Mechanical Engineering; the selection to be made by Mrs. Haines herself during her life-time.

WILBUR PRIZES.

By the generosity of E. P. Wilbur, Esq., a fund has been established, yielding an annual income of $100, for distribution in prizes as the Faculty shall determine.

ALUMNI PRIZES FOR ORATORY.

The "Alumni Association of the Lehigh University" has established an annual sum of Fifty Dollars, to be distributed as prizes for excellence in Oratory, subject to the following

REGULATIONS.

1. The Contest shall be held on the 22d day of February, or on the day designated by the University to commemorate the birthday of Washington.

2. There shall be a first prize of $25, a second of $15, and a third of $10.

3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.

4. Subjects for the oration shall be announced at the beginning of the first term of every year, and upon one of these each competitor shall write an oration not to exceed eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do —should they be sufficient in number—the best six shall be chosen, and their envelopes opened. The others shall be returned to the address given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors whose orations shall have been approved, and the awards shall be made by a majority of these judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

At the last contest, the First Prize was awarded to Schuyler Brush Knox; the Second, to Joseph Clinton Ballou; the Third, to Edwin Clark Reynolds.

The next contest will take place February 22, 1893.

ENTRANCE EXAMINATION PAPERS.

Used for Examination in 1892.

[Requests for other examination papers than those herein printed can not be granted.]

I.—ENGLISH.

1. Distinguish between *The Qualities of Style* and *The Elements of Style.*

2. Define and discuss *Picturesqueness.*

3. What is *Invention* and how is it related to *Arrangement and Style?*

4. Distinguish between *Narration* and *Description.*
In what does the Unity of a Narrative consist?

5. What are the four principal varieties of English feet?
Rearrange the following into lines and indicate their scansion by accents:

A land of streams! some, like a downward smoke, slow-dropping veils of thinnest lawn, did go; and some through wavering lights and shadows broke, rolling a slumbrous sheet of foam below. They saw the gleaming river seaward flow from the inner land; far off, three mountain tops, three silent pinnacles of aged snow, stood sunset-flushed; and, dewed with showery drops, upclomb the shadowy pine above the woven copse.

6. What is the difference between *Deduction* and *Induction?*
Tell what you can about the *Burden of Proof.*

7. Distinguish between the meanings of *Perpetrate* and *Commit.*

8. Write an essay of at least 200 words on *Macaulay's Development of the Character of Lord Clive.* The value of this essay is thirty per cent. of the entire value of the paper.

II.—GEOGRAPHY.

Outline maps of the central part of the United States and of Northern Europe, were furnished to each applicant and he was required to draw the boundaries of countries,

provinces, states, and territories, and name them, to place and name the capital or chief city of each, and the principal rivers and mountain systems.

III.—UNITED STATES HISTORY.

1. *a.* When, where, and by whom were the two settlements made in Massachusetts?
   b. How long did these two colonies remain distinct, and under what charter were they united?
2. *a.* What were the Navigation Acts?
   b. When were they passed?
3. *a.* Who was United States agent in France in 1778?
   b. What treaty was made with France in this year?
   c. What military event facilitated the making of this treaty?
4. Give an account of Washington's movements in 1778.
5. What were the Articles of Confederation, and when were they adopted?
6. Name the leading events of John Adams' administration.
7. What is meant by the "American System?"
8. What was the "Omnibus Bill," and by whom was it proposed?
9. What were the military events in the East in 1863?
10. Name the leading events of Grant's second term.

CONSTITUTION.

1. *a.* To what body are legislative powers given?
   b. What are its branches?
2. *a.* How is the Senate composed?
   b. How are Senators chosen?
   c. How long do they serve?
   d. What are their qualifications?
3. *a.* What rank does the President hold in the army and navy?
   b. How are treaties made?
   c. How are extra sessions of Congress called?

4. *a.* In what does treason consist?
   b. How must it be proved?
   c. How is it to be punished?
5. *a.* What rights have citizens when they remove to another State?
   b. How are escaped criminals brought back to the State where the crime was committed?

IV.—ARITHMETIC.

1. (*a*) What is a unit? An abstract number? A concrete number?
   (*b*) Write the following numbers:
   Sixteen billions sixteen millions and sixteen.
   Twelve thousand twelve hundred and twelve.
   One thousand and one thousandth.
   (*c*) Give rules for position of the decimal point in addition, subtraction, multiplication, and division.
2. (*a*) What is an account? A debtor? A creditor? What is percentage?
   (*b*) Give number of feet in a rod; rods in a miles; inches in a metre; metres in a kilometre: square rods in one acre.
   (*c*) What is discount? Bank discount? A specific duty? An *ad valorem* duty?
3. $1\frac{1}{2} + .0075 + 14\frac{2}{13} - \frac{17}{7}$ = what? (Reduce to a decimal.)
4. 10 gallons $2\frac{2}{3}$ pints, how many litres?
5. Find interest, discount, and bank discount on $14.49 for 90 days at $4\frac{1}{2}\%$.
6. A, B, and C are under contract to furnish 6000 bushels of corn at 48 cents per bushel. A's corn is worth 45 cents, B's 51 cents, C's 54 cents. How many bushels must each furnish?

V.—GEOMETRY.

1. (*a*) Define the terms *theorem*, *corollary*, *lemma*, *axiom*.
   (*b*) What are parallel right lines? Perpendicular right lines? What is a re-entrant angle?

(*c*) What are incommensurable quantities? When are two incommensurable ratios equal? Illustrate these definitions.

2. (*a*) What is the distinction between *equal and equivalent?* Define similar polygons and regular polygons.

(*b*) What is the arithmetic mean between two quantities? What the geometric mean? What are the segments of a right line? The segments of a circle?

(*c*) Circumferences of circles are in what ratio? What is the ratio of the areas of circles? Define triedral and polyedral angles. What do you know about the face-angles of such angles?

3. From a point without a line one and but one perpendicular can be drawn to the line.

4. Draw four circles tangent to the three sides of a triangle.

5. Two parallels are divided by straight lines passing through a common point into proportional segments, and conversely.

6. Find sum of squares of four sides of any quadrilateral in terms of its diagonals.

7. The areas of similar polygons are in ratio of squares of homologous sides.

8. The area of a circular ring is equal to that of a circle whose diameter is a chord of the outer circle and a tangent to the inner circle.

9. The locus of points equidistant from faces of a diedral angle is its bisecting plane.

10. Two triedral angles are either equal or symmetrical when three face-angles of the one are equal to three face-angles of the other.

VI.—ALGEBRA.

1. Describe the different methods of elimination.

Define coefficients and exponents as symbols of operation.

Write the general form of an equation of the second degree (one unknown quantity), and the expression for its roots.

2. For what operations must radicals be similar, and for what need they be only of the same degree?

Define the progressions, and give the relations of the quantities involved.

Define homogeneous, simultaneous, and independent equations.

3. Expand $(x^{-2}-y)^{-\frac{1}{2}}$ and $(x^2-y^2)^{\frac{1}{2}}$ to five terms by the binomial formula.

4. Extract the square root of 0.9 to three places, and explain the process.

5. Solve $\dfrac{\sqrt{6x}-2}{\sqrt{6x}+2}=\dfrac{4\sqrt{6x}-9}{4\sqrt{6x}+7}$; $\dfrac{ax-b}{4}+\dfrac{a}{3}=\dfrac{bx}{2}-\dfrac{bx-a}{3}$.

6. Solve $x+\frac{1}{2}y=100$, $y+\frac{1}{3}z=100$, $z+\frac{1}{4}x=100$.

7. Solve $2\sqrt{x}+\dfrac{2}{\sqrt{x}}=5$. $\sqrt{x+8}-\sqrt{x+3}=\sqrt{x}$. Verify.

8. Required the price of eggs when at 1 cent less per dozen there are five more in a dollar's worth.

9. A fore wheel of a carriage makes 6 more revolutions in going 120 yards than does the hind wheel; if the rims of the fore wheels are increased one-fourth, and the rims of the hind wheels one-fifth, a fore wheel will make but 4 more turns than a hind wheel in going the same distance. Required the size of each.

10. $x^2+y^2+x+y=18,$
$xy=6.$
$x^2+y^2=12,$
$xy=20.$

VII.—PHYSICS.

1. Define:

a. Force.
b. Resolution of forces.
c. Accelerated velocity.

d. Work.
e. Specific inductive capacity.
f. Electrolysis and electrolyte.
g. Shunt.
h. Fundamental tones.
i. Sympathetic vibrations.
j. Temperature.
k. Chromatic aberration.
l. Total reflection.

2. Derive the formula for kinetic energy.

3. How would you find the specific gravity of a solid with the Nicholson's hydrometer?

4. Explain the action of the syphon.

5. How can the principal focal distance of a lens be determined experimentally?

6. What is Mariotte's law and how is it verified by experiment?

7. A piece of lead weighs 1135 grains in air, 1035 grains in water, and when attached to a cork weighing 24 grains they together weigh 935 grains in water. What is (*a*) specific gravity of the lead, (*b*) of the cork, (*c*) volume of lead, (*d*) volume of cork.

8. At the top of an inclined plane 100 feet long and 25 feet high is a wheel and axle. Radius of wheel is 3 feet; radius of axle is 4 inches. What load can be supported on the plane by a power of 50 pounds applied to the wheel?

9. A current of 20 amperes is passed through three wires placed parallel, having resistances of 4, 5, and 6 ohms respectively. What is the combined resistance and how much current flows through each branch?

10. A gas measures 100 c. m. at 212° F. under a pressure of 30 in. of mercury. Find its volume at 300° F. under a pressure of 40 in. of mercury. Use F. degrees.

11. A ball weighing 100 pounds is dropped from a tower 1000 feet high. Find (*a*) its final velocity, (*b*) how much copper (specific heat .0952) it could raise from 10° to 20° C.,

if all its energy were converted into heat and applied to the copper.

12. A rod 12 in. long is placed 15 in. beyond the center of curvature of a concave mirror and forms an image 5 in. in front of the center of curvature. What is the size of the image?

VIII.—PHYSICAL GEOGRAPHY.

1. Name the motions of the earth, state proofs and what they cause.
2. Give classification of lakes with an example of each.
3. Give classification of winds with description of each class.
4. Describe the Gulf stream.
5. What causes (*a*) hoarfrost, (*b*) dew, (*c*) hail?
6. Describe the rainbow.
7. Name and locate chief minerals of the United States.
8. Give the characteristics and distribution of the Caucasian race.
9. Describe the electrical phenomena of the atmosphere.
10. What are deltas, and where found in the United States?

IX.—LATIN.

I. Grammar.

Decline and give the gender of the nouns in the following sentences, and state wherein any of them are exceptions to the general rules for gender and declension.

> Dum pelago desaevit hiemps et aquosus Orion
> Quassataeque rates, dum non tractabile caelum.
> Sic effata sinum lacrimis implevit obortis.

Give the principal parts and complete synopsis of the 1st person singular of the verbs in the above lines. Explain the derivation of the adjectives in these lines with the force of the terminations. Decline the personal and relative pronouns and state the position of these pronouns with reference to the preposition when used with *de* and *cum* respectively. Compare *magis*, *similis*, *malus*, *idoneus*. Inflect *nolo* and *odi*.

Give the various uses of the Genitive with nouns. What cases are used with *dignus*, *similis*, *potior*, verbs of remembering, verbs of teaching, verbs of sparing? How are the supine forms in *um* and *u* employed? When does *quod* (because) take the Subjunctive and when the Indicative? What Latin constructions are imitated from the Greek?

II. Cæsar.

Translate:

Cognito Caesaris adventu Ariovistus legatos ad eum mittit: quod antea de colloquio postulasset, id per se fieri licere, quoniam propius accessisset, seque id sine periculo facere posse existimare. Non respuit condicionem Caesar jamque eum ad sanitatem reverti arbitrabatur, cum id, quod antea petenti denegasset, ultro polliceretur, magnamque in spem veniebat, pro suis tantis populique Romani in eum beneficiis cognitis suis postulatis fore, uti pertinacia desisteret.

Give the syntax of *adventu*, *existimare*, *desisteret*.

Translate:

Crassus equitum praefectos cohortatus, ut magnis praemiis pollicitationibusque suos excitarent, quid fieri velit, ostendit. Illi, ut erat imperatum, eductis iis cohortibus, quae praesidio castris relictae intritae ab labore erant, et longiore itinere circumductis, ne ex hostium castris conspici possent, omnium oculis mentibusque ad pugnam intentis celeriter ad eas, quas diximus, munitiones pervenerunt atque his prorutis prius in hostium castris constiterunt, quam plane ab his videri aut, quid rei gereretur, cognosci posset.

III. Vergil.

Translate:

Lucus in urbe fuit media, laetissimus umbra,
quo primum jactati undis et turbine Poeni
effodere loco signum, quod regia Juno
monstrarat, caput acris equi; sic nam fore bello
egregiam et facilem victu per saecula gentem.
Hic templum Junoni ingens Sidonia Dido

condebat, donis opulentum et numine divae,
aerea cui gradibus surgebant limina, nexaeque
aere trabes, foribus cardo stridebat aenis.

Give the syntax of *umbra*, *undis*, and *victu*. Explain the forms *monstrarat* and *fore*. Decline *Dido*.

Translate:

Nox erat, et terris animalia somnus habebat:
effigies sacrae divom Phrygiique Penates,
quos mecum a Troia mediisque ex ignibus urbis
extuleram, visi ante oculos adstare jacentis
in somnis, multo manifesti lumine, qua se
plena per insertas fundebat luna fenestras;
tum sic adfari et curas his demere dictis:
'Quod tibi delato Ortygiam dicturus Apollo est,
hic canit, et tua nos en ultro ad limina mittit.

What were the *Penates?* What is *qua?*

Translate:

Respicit Aeneas subito, et sub rupe sinistra
moenia lata videt, triplici circumdata muro,
quae rapidus flammis ambit torrentibus amnis
Tartareus Plegethon, torquetque sonantia saxa.
Porta adversa ingens, solidoque adamante columnae,
vis ut nulla virum, non ipsi exscindere bello
caelicolae valeant; stat ferrea turris ad auras,
Tisiphoneque sedens, palla succincta cruenta,
vestibulum exsomnis servat noctesque diesque.
Hinc exaudiri gemitus, et saeva sonare
verbera; tum stridor ferri, tractaeque catenae.

Write out the first two lines marking the quantity of each syllable, separating the feet and indicating the caesura.

IV. Cicero.

Translate:

O condicionem miseram non modo administrandae, verum etiam conservandae rei publicae! Nunc si L. Catilina consiliis, laboribus, periculis meis circumclusus ac debilitatus subito pertimuerit, sententiam mutaverit, deseruerit

suos, consilium belli faciendi abjecerit, ex hoc cursu sceleris ac belli iter ad fugam atque in exsilium converterit,—non illea me spoliatus armis audaciae, non obstupefactus ac perterritus mea diligentia, non de spe conatuque depulsus, sed indemnatus, innocens, in exsilium ejectus a consule vi et minis esse dicetur; et erunt qui illum, si hoc fecerit, non improbum, sed miserum, me non diligentissimum consulem, sed crudelissimum tyrannum existimari velint! (*In Catilinam, Or. II.*)

Atque sic a summis hominibus eruditissimisque accepimus, ceterarum rerum studia et doctrina et praeceptis et arte constare: poëtam natura ipsa valere, et mentis viribus excitari, et quasi divino quodam spiritu inflari. Qua re suo jure noster ille Ennius sanctos appellat poëtas, quod quasi deorum aliquo dono atque munere commendati nobis esse videantur. (*Pro Archia.*)

V. Sight.

Translate:

Vatinius Brundisii cum esset, cognitis rebus, quae gestae erant in Illyrico, cum crebris litteris Cornificii ad auxilium provinciae ferendum evocaretur et M. Octavium audiret cum barbaris foedera percussisse compluribusque locis nostrorum militum oppugnare praesidia partim classe per se partim pedestribus copiis per barbaros, etsi gravi valetudine affectus vix corporis viribus animum sequebatur, tamen virtute vicit incommodum naturae difficultatesque et hiemis et subitae praeparationis.

VI. Prose Composition.

The Helvetians being induced (*adduco*) by love for their native land sent embassadors to Caesar to treat with him in regard to a surrender (*deditio*) in order that they might return home. When these had met him while yet on the march, he ordered them to bring hostages (*obses*) so that he might know that they would keep the treaty inviolate. He delayed his journey three days gladly, because he perceived that his troops were weary and could not pursue rapidly.

VII. Roman History.

1. Mention the different forms of the government of Rome with the dates and the circumstances attending the introduction of each.

2. Give an account of the war with Jugurtha.

3. Give the life of Hannibal with dates.

4. Mention all battles that were turning points in Roman history with the results, the dates, and the names of the chief combatants.

5. Give an account of the two triumvirates.

X.—GREEK.

I. Grammar.

1. *a.* Write correctly *πέπειθμαι, νυκτσί, συνβάλλω, ὀρνίθσι.*

b. Contract *τιμάειν, τιμάου, τιμαοίην, τιμάῃς.*

c. Accent *ἀνθρωποι τινες, ἀνδρες εἰσιν.*

2. Decline through the singular *θάλασσα, νοῦς, σώφρων, ἀληθής*: through the plural *μέγας, λελυκώς, πόλις, ναῦς.*

3. Give the genitive, singular and plural, of *χαρίεις, λυθείς, λύων, λύσας*: the dative, singular and plural, of *χείρ, γυνή, ἰχθύς, ἱππεύς*: the accusative, singular and plural, of *χάρις, ἐλπίς, πόλις, βοῦς.*

4. Compare *ἀγαθός, κακός, μικρός, ταχύς.*

5. Give the genitive, singular and plural, of the reflexive pronoun, third person; of the indefinite relative pronoun; of *οὗτος, αὐτός.*

6. Translate *sixth, three times, ten, whence? whither?*

7. Give the future (first person singular) of *τρέχω*: the second aorist active of *πίπτω*: the perfect active of *φαίνω*: the perfect middle of *καλέω*: the aorist passive of *τίθημι.*

8. Give the synopsis of the present, active and middle, of *δίδωμι*: of the first and second aorists, active, of *ἵστημι*: of the second aorist passive of *φαίνω.*

9. Inflect the imperfect, active and middle, of *δείκνυμι*: the aorist indicative, active and middle, of *ἵημι*: the present optative active of *φιλέω.*

10. *φανῶ, λυθῶ, τυθῶ, ἐτίμω*: where made? Give in each case the first person singular (*a*) of the indicative of the same tense, (*b*) of the present indicative.

II. Xenophon.

1. *Translate:*

Ὦ ἄνδρες Ἕλληνες, οὐκ ἀνθρώπων ἀπορῶν βαρβάρων συμμάχους ὑμᾶς ἄγω, ἀλλὰ νομίζων ἀμείνους καὶ κρείττους πολλῶν βαρβάρων ὑμᾶς εἶναι, διὰ τοῦτο προσέλαβον. ὅπως οὖν ἔσεσθε ἄνδρες ἄξιοι τῆς ἐλευθερίας ἧς κεκτήσθε καὶ ἧς ὑμᾶς ἐγὼ εὐδαιμονίζω. εὖ γὰρ ἴστε, ὅτι τὴν ἐλευθερίαν ἑλοίμην ἂν ἀντὶ ὧν ἔχω πάντων καὶ ἄλλων πολλαπλασίων. ὅπως δὲ καὶ εἰδῆτε, εἰς οἷον ἔρχεσθε ἀγῶνα, ἐγὼ ὑμᾶς εἰδὼς διδάξω. τὸ μὲν γὰρ πλῆθος πολὺ καὶ κραγῇ πολλῇ ἐπίασιν· ἐὰν δὲ ταῦτα ἀνάσχησθε, τὰ ἄλλα καὶ αἰσχυνεῖσθαί μοι δοκῶ, οἵους ἡμῖν γνώσεσθε τοὺς ἐν τῇ χώρᾳ ὄντας ἀνθρώπους. ὑμῶν δὲ ἀνδρῶν ὄντων καὶ εὐτόλμων γενομένων, ἐγὼ ὑμῶν τὸν μὲν οἴκαδε βουλόμενον ἀπιέναι τοῖς οἴκοι ζηλωτὸν ποιήσω ἀπελθεῖν, πολλοὺς δὲ οἰμαι ποιήσειν τὰ παρ' ἐμοὶ ἑλέσθαι ἀντὶ τῶν οἴκοι.

Explain the construction of *ἀνθρώπων* (l. 1), *βαρβάρων* (l. 2), *ἐλευθερίας* (l. 3), *ἧς* (l. 3), *ἧς* (l. 4): of the participles *ἀπορῶν* (l. 1), *ὄντας* (l. 9), *γενομένων* (l. 9), *βουλόμενον* (l. 10): of the optative *ἑλοίμην* (l. 5); of *οἵους* (l. 8), *κραγῇ* (l. 7) *τοῖς οἴκοι* (l. 10).

ἐὰν ἀνάσχησθε (l. 7): what is the apodosis? Vary to the "less vivid" form.

What is the subject of *ἐπίασιν* (l. 7)?

Explain the difference in mood and tense between *ὅπως ἔσεσθε* (l. 3) and *ὅπως εἰδῆτε* (l. 6).

2. *Translate:*

Ἐνθα δὴ Καλλίμαχος μαχαιρᾶται τι· προέτρεχεν ἀπὸ τοῦ δένδρου, ἐφ' ᾧ ἦν αὐτός, δίο ἢ τρία βήματα· ἐπεὶ δὲ οἱ λίθοι φέροιντο, ἀνεχάζετο εὐπετῶς· ἐφ' ἑκάστῃς δὲ προδρομῇς πλέον ἢ δέκα ἁμαξαι πετρῶν ἀνηλίσκοντο. ὁ δὲ Ἀγασίας ὡς ὁρᾷ τὸν Καλλίμαχον ἃ ἐποίει καὶ τὸ στράτευμα πᾶν θεώμενον, δείσας, μὴ οἱ πρῶτος παραδράμοι εἰς τὸ χωρίον, οἴτε τὸν Ἀριστώνυμον πλησίον ὄντα παρακαλέσας οἴτε Εὐρύλοχον τὸν Λουσιέα ἑταίρους ὄντας οὐδ' ἄλλον οὐδένα χωρεῖ αὐτὸς καὶ παρέρχεται πάντας. ὁ δὲ Καλλίμαχος ὡς ὁρᾷ αὐτὸν παρόντα, ἐπιλαμβάνεται αὐτοῦ τῆς ἵππου. ἐν δὲ τούτῳ παραθεῖ αὐτοῖς Ἀριστώνυμος Μεθυδρεὺς καὶ μετὰ τοῦτον Εὐρύλοχος Λουσιεύς· πάντες γὰρ οὗτοι ἀντεποιοῦντο ἀρετῆς καὶ διηγωνίζοντο πρὸς ἀλλήλους· καὶ οὕτως ἐρίζοντες αἱροῦσι τὸ χωρίον.

Explain the construction of the participle *θεώμενον* (l. 4); of the optatives *φέροιντο* (l. 2), *παραδράμοι* (l. 5); of the genitives *ἴτνος* (l. 8), *ἀρετῆς* (l. 10).

3. *Translate at sight:*

Ἀκούω τινὰ διαβάλλειν, ὦ ἄνδρες, ἐμέ, ὡς ἐγὼ ἄρα ἐξαπατήσας ὑμᾶς μέλλω ἄγειν εἰς Φᾶσιν. ἀκούσατε οὖν μου πρὸς θεῶν, καὶ ἐὰν μὲν ἐγὼ φαίνωμαι ἀδικεῖν, οὐ χρή με ἐνθένδε ἀπελθεῖν, πρὶν ἂν δῶ δίκην· ἐὰν δ' ὑμῖν φαίνωνται ἀδικεῖν οἱ ἐμὲ διαβάλλοντες, οὕτως αὐτοὺς χρῆσθε ὥσπερ ἄξιον. ὑμεῖς δ', ἔφη, ἴστε δήπου, ὅθεν ἥλιος ἀνίσχει καὶ ὅπου δύεται, καὶ ὅτι ἐὰν μέν τις εἰς τὴν Ἑλλάδα μέλλῃ ἰέναι, πρὸς ἑσπέραν δεῖ πορεύεσθαι, ἢν δέ τις βούληται εἰς τοὺς βαρβάρους, τοὐμπαλὶν πρὸς ἕω. ἀλλὰ μὴν καὶ τοῖτό γε ἐπίστασθε, ὅτι βορέας μὲν ἔξω τοῦ Πόντου εἰς τὴν Ἑλλάδα φέρει, νότος δὲ εἴσω εἰς Φᾶσιν, καὶ λέγεται, ὅταν βορρᾶς πνέῃ, ὡς καλοὶ πλοῖ εἰσιν εἰς τὴν Ἑλλάδα.

ἀνίσχω, rise. *δύομαι*, set. *τοὐμπαλὶν* (*τὸ ἐμπαλὶν*), backward. *πνέω*, blow. *πλοῦς*, voyage.

III. Homer.

Ὅντινα μὲν βασιλῆα καὶ ἔξοχον ἄνδρα κιχείῃ,
τὸν δ' ἀγανοῖς ἐπέεσσιν ἐρητύσασκε παραστάς·
Δαιμόνι, οὔ σε ἔοικε κακὸν ὥς δειδίσσεσθαι,
ἀλλ' αὐτός τε κάθησο καὶ ἄλλους ἵδρυε λαούς.
οὐ γάρ πω σάφα οἶσθ' οἷος νόος Ἀτρείωνος·
νῦν μὲν πειρᾶται, τάχα δ' ἰψεται υἷας Ἀχαιῶν.
ἐν βουλῇ δ' οὐ πάντες ἀκούσαμεν οἷον ἔειπεν.
μή τι χολωσάμενος ῥέξῃ κακὸν υἷας Ἀχαιῶν.
θυμὸς δὲ μέγας ἐστὶ Διοτρέφεος βασιλῆος·
τιμὴ δ' ἐκ Διός ἐστι, φιλεῖ δέ ἑ μητίετα Ζεύς.

Prose forms of *βασιλῆα* (l. 1), *ἐπέεσσιν* (l. 2), *υἷας* (l. 6), *ἀκούσαμεν* (l. 7), *ἑ* (l. 10)?

Explain the construction of *κιχείῃ* (l. 1), *ῥέξῃ* (l. 8), *υἷας* (l. 8).

Force of *δέ* (l. 2); of *σκ* in *ἐρητύσασκε* (l. 2); of *ὡς* (l. 3)?

Mark feet and caesuras in lines 3–7. Why are *ε* in *σε* (l. 3), and *α* in *σάφα* (l. 5) not elided? What is the quantity of *ο* in *κακόν* (l. 3)? Why? Of *αι* in *καί* (l. 4)? Why?

Οὗτος δ' Αἴας ἐστὶ πελώριος, ἕρκος Ἀχαιῶν·
Ἰδομενεὺς δ' ἐπέρωθεν ἑνί Κρήτεσσι θεὸς ὡς
ἕστηκ', ἀμφὶ δέ μιν Κρητῶν ἀγοὶ ἠγερέθονται.
πολλάκι μιν ξείνισσεν ἀρηΐφιλος Μενέλαος
οἴκῳ ἐν ἡμετέρῳ, ὁπότε Κρήτηθεν ἵκοιτο.
νῦν δ' ἄλλους μὲν πάντας ὁρῶ ἑλίκωπας Ἀχαιούς,
οὓς κεν ἐῢ γνοίην καί τ' οὔνομα μνθησαίμην·
δοιὼ δ' οὐ δύναμαι ἰδέειν κοσμήτορε λαῶν,
Κάστορά θ' ἱππόδαμον καὶ πὺξ ἀγαθὸν Πολυδεύκεα,
αὐτοκασιγνήτω, τώ μοι μία γείνατο μήτηρ·
ἢ οὐχ ἑσπέσθην Λακεδαίμονος ἐξ ἐρατεινῆς,
ἢ δείρω μὲν ἕποντο νέεσσ' ἐνι-ποντοπόροισιν,
νῦν αὖτ' οὐκ ἐθέλουσι μάχην καταδύμεναι ἀνδρῶν,
αἴσχεα δειδιότες καὶ ὀνείδεα πόλλ', ἃ μοί ἐστιν.

IV. History.

1. Give an account of Peisistratus and his sons.
2. Who was Themistocles? Aristeides? Brasidas? Kleon? Agesilaus?
3. At what period was Athens most powerful? Who was at that time her chief leader? How was her power destroyed?
4. Give an account of the expedition of Cyrus.
5. Describe the political career of Demosthenes.

ALUMNI

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Lester Warren Walker, E.E., Assistant Superintendent, Electric Power Co., Savannah, Ga.
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Frederic Wittman, A.C., Lanark, Pa.
Charles Oaks Wood, M.E., Chambersburg, Pa.
Byron Edgar Woodcock, C.E., 332 Broadway, Pueblo, Col.

The number of Graduates is 525, of whom 34 have taken the degree of B.A.; 7 of Ph.B.; 60 of B.S.; 7 of B.M.; 213 of C.E.; 107 of M.E.; 51 of E.M.; 16 of E.E.; 59 of A.C.; 7 of M.A.; 1 of M.S. Of these 1 has taken the degrees of B.A. and B.M.; 7 of B.A. and M.A.; 2 of B.S. and C.E.; 1 of B.S. and A.C.; 19 of B.S. and E.M.; 1 of C.E. and E.M.; 3 of A.C. and E.M.; 1 of A.C. and M.S.

The following have been awarded certificates for the

ADVANCED COURSE IN ELECTRICITY.

CLASS OF 1885.

Elmer Ellsworth Boyer, Foreman Arc Testing Department, Thomson-Houston Electric Co., Lynn, Mass.

Horace Musser Engle, President Montor Steam Generator Manufacturing Co., Roanoke, Va.

Charles Leavitt Jenness, Western Electric Co., Chicago, Ill.

George Herman Koehler, Standard Underground Cable Co., Pittsburg, Pa.

George Herbert Putnam, Instructor in Minnesota School for the Deaf, Faribault, Minn.

Lewis Buckley Stillwell, Assistant Electrician, Westinghouse Electric Co., Pittsburgh, Pa.

CLASS OF 1886.

Edward Conner, Philadelphia, Pa.

James Arthur Heaton, Boston, Mass.

William Hoopes, Superintendent Edison Electric Co.'s Station, West Chester, Pa.

Walter Eugene Hyer, Thomson-Houston Electric Co., Newburyport, Mass.

Robert McAllister Loyd, Assistant Electrician, Daft Electric Co., Newark, N. J.

George Harrison Neilson, Construction Dept. Pennsylvania R. R., 1105 Eutaw St., Baltimore, Md.

Charles Jacob Meade, Edison Electric Illuminating Co. of New York, 348 W. 20th Street, New York City.

CLASS OF 1887.

Walter George Fuller, Brattleboro, Vermont.

John Wesley Hackney, Graphic Process Co., Pleasantville, N. J.

William Sigler Jones, Wharton Railroad Switch Co., 7 East Penn Street, Germantown, Pa.

Dion M. Martinez, jr., Reading R. R. Co., Philipsburg, Centre Co., Pa.

Horace Fields Parshall, Edison General Electric Co., Schenectady, N. Y.

Arthur Douglas Spear, Brush Electric Co., Cleveland, O.

George Henry Wolle, Electrical Accumulator Co., 44 Broadway, New York City.

CLASS OF 1888.

Albert Brodhead, 121 S. Centre Street, Bethlehem. Pa.

William Fairchild Dean, Thomson-Houston Electric Co., 91 Warren Street, Lynn, Mass.

Herman Frauenthal, Wilkes-Barre, Pa.

Richard Otto Albert Heinrich.

Joseph Allison Horner, Brush Electric Light Co., Philadelphia, Pa.

William Henry Hubbard, Superintendent of the Beaver Valley Electric Light and Power Co., Beaver Falls, Pa.

Daniel Henry Jenkins, Mutual Electric and Accumulator Co., 76 Ashland Place, Brooklyn, N. Y.

Charles Jacob Miller, Brush Electric Light Co., 720 N. 5th Street, Philadelphia, Pa.

James Leidy Moore, Thomson-Houston Electric Co., Lynn, Mass.

Charles Norris Robinson, Wynkoop & Robinson, Manufacturers of Artificial Stone, 4948 Main Street, Germantown, Pa.

Harry Meyer Seitzinger, Germantown, Pa.

Charles Wesley White, Excelsior Electric Co., Brooklyn, N. Y.

Hugh Carlyle Young, Testing Department, Edison Machine Works, 224 Union Street, Schenectady, N. Y.

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From B. H. Cramp & Co.

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Report of the Superintendent of Education on the Public Schools of Nova Scotia.

From Horace Kephart, St. Louis, Mo.

Forty-Sixth Annual Report of the St. Louis Mercantile Library Association, 1891.

From Eugene Ricksecker, Olympia, Wash.

First and Second Annual Reports of the State Geologist on Mines and Minerals of Washington.

From Prof. John C. Smock, Trenton, N. J.

Report of the State Geologist of New Jersey for 1891.

From William Himrod, Erie, Pa.

Annual Report of the Commissioners of Water Works of Erie, Pa., for 1891.

From Chas. E. Ronaldson, New York.

The Philosophy of Experimental Chemistry, Volume 2, by J. Cutbush.

Longworth's New York Register and City Directory for 1818.

From Theodere Cooper, New York.

Report of the Rapid Transit Commissioners, to the Massachusetts Legislature.

From C. L. Johnson, Albany, N. Y.

Annual Report of the State Engineer and Surveyor of New York for 1890.

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From the Harvard University Library.

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From the Massachusetts State Library.

Report of the Librarian.

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From the Agricultural College, Michigan.

Thirteenth Annual Report of the Secretary of the Michigan State Board of Agriculture, 1891.

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Catalogue of the Library of the Association.

From the American Bankers Association.

Education of Business Men, Part 2.

Proceedings of the Convention at New Orleans.

From the New York State Library.

State Library Bulletins—Legislation, No. 2. Additions, No, 1. Library School, No. 1.

State Museum Report, Vol. 44, 1891.

Regents' Bulletins, Nos. 1-7.

Seventy-Third Annual Report of the Regents.

Extension Bulletin No. 1. State Museum Bulletin No. 1.

From the U. S. Naval Observatory.

Washington Observations, 1887 and 1888. 2 volumes.

From the Observatorio Nacional Argentino.

Resultados del Observatorio, Vol. 13.

From the Institution of Civil Engineers, England.

Minutes of Proceedings, Vols. 106, 107, 108, 109, 110.

Engineering Education in the British Dominions.

Brief Subject Catalogue to Vols. 69-106.

From the American Society of Mechanical Engineers.

Transactions, Vols. 6 and 12.

From the American Society of Mining Engineers.

Transactions, Vols. 19 and 20.

From the Pennsylvania Railroad.

Forty-Fifth Annual Report, 1891.

From the Allgemeiner Deutscher Sprachverein, Germany.

Ein Hauptstück von Unserer Muttersprache.

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Special Consular Reports, 4 Pamphlets.

Consular Reports, 133 to 137, 142, 143.

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Annual Report of the Chief of the Bureau of Steam Engineering for 1891.

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Official Army Register, January, 1892.

Annual Report of the Chief of Engineers of the U. S. Army for 1891. 6 volumes.

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Circulars of Information, Nos. 2, 4, 5, 6, 7, 8, 9, 1891. No. 1, 1892.

Catalogue of Educational Literature, Part 1.

From the U. S. Department of Agriculture.

On Climate. 5 Pamphlets.

Rainfall from 2 to 40 years.

Timber Physics, Part 1.

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First Report.

From the U. S. Coast and Geodetic Survey.

Annual Report for 1890.

From the U. S. Geological Survey.

Two Hundred and Six Atlas Sheets and Relief Map of the United States.

From the U. S. Fish Commission.

Bulletin of the U. S. Fish Commission, Vol. 9, 1889.

From the Smithsonian Institution.

Contributions to Knowledge, Vol. 28.

Smithsonian Report for 1889.

Bulletin of the U. S. National Museum, Nos. 41 and 42.

From the Second Geological Survey of Pennsylvania.

Report of the Survey, 6 volumes.

From the Authors.

Economic and Industrial Delusions, by A. B. Farquhar.

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An Address upon the late Joseph Leidy, by Wm. Hunt, M. D.

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Centennial Anniversary of Quincy, Mass. Address, by Charles Francis Adams.

From the Publishers.

Bethlehem Daily Times.

South Bethlehem Star.

Philadelphia Evening Telegraph.

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Moravian.

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Southwark Foundry and Machine Co., Philadelphia.
Straight Line Engine Co., Syracuse, N. Y.
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OF

THE LEHIGH UNIVERSITY,

SOUTH BETHLEHEM, PA.

1893-1894.

FOUNDED BY ASA PACKER.

BETHLEHEM, PA.:
TIMES PUBLISHING COMPANY.
1893.

TABULAR ALMANAC.

1893.

JULY.

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AUGUST.

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MAY.

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JUNE.

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CALENDAR.

1893.	1893-1894.	
Sept. 9, 11, 12,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 13,	Wednesday, . .	First Term begins.
Oct. 12,	Thursday, . .	Founder's Day.
Nov. 30,	Thursday, . .	Thanksgiving Day.
Dec. 20,	Wednesday, .	First Term ends.
1894.		
Jan. 9, 10,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 10,	Wednesday, .	Second Term begins.
Jan. 20,	Saturday, . .	Junior Prize Orations due.
Feb. 7,	Wednesday, .	Ash Wednesday.
Feb. 22,	Thursday, . .	Washington's Birthday.
March 22,	Thursday, . .	Easter Holidays begin.
March 27,	Tuesday, . .	Easter Holidays end at $8\frac{1}{4}$ A.M.
May 28,	Monday, . .	University Day Orations due.
May 30,	Wednesday, . .	Theses of Seniors due.
May 30,	Wednesday, .	Senior Examinations begin.
June 11,	Monday, . . .	Annual Examinations begin.
June 17,	Sunday, . .	Baccalaureate Sermon.
June 18,	Monday, . . .	Class Day.
June 20,	Wednesday, .	University Day.
Jun. 21, 22, 23,	Thursday, Friday, and Saturday,	Examinations for Admission.
1894.	**1894-1895.**	
Sept. 8, 10, 11,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 12,	Wednesday, . .	First Term begins.
Oct. 11,	Thursday, . .	Founder's Day.
Nov. 29,	Thursday, . .	Thanksgiving Day.
Dec. 19,	Wednesday, .	First Term ends.
1895.		
Jan. 8, 9,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 9,	Wednesday, . .	Second Term begins.
June 19,	Wednesday, .	University Day.

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*Norman Frederic Clark,	E.E.,	Philadelphia.
Arthur Stebbins Clift,	M.E.,	Croton Falls, N. Y.
*Edward Perrine Cody,	C.E.,	Philadelphia.
William Wheeler Coleman,	E.M.,	Baltimore, Md.
William J. Collier,	C.E.,	Duncannon.
Herbert Maurice Crawford,	C.E.,	Manorville.
*Henry M. S. Cressman,	Clas.,	Sellersville.
Howard Stephen Dech,	M.E.,	Bethlehem.
Henry De Huff,	E.E.,	Lebanon.
Stanley Chipman de Witt,	E.E.,	Halifax, N. S.
James Chambers Dick,	C.E.,	Brockwayville.
*Benjamin Irvin Drake,	E.M.,	South Bethlehem.
Beekman Dubarry, jr.,	M.E.,	Washington, D. C.
Howard Eckfeldt,	E.M.,	Conshohocken.
*Alfred Wm. Alexander Eden,	C.E.,	Brown's Town, Jamaica.
Edward L. Faison, jr.,	C.E.,	Elliott, N. C.
Guy Hector Farman,	E.M.,	Westfield, Vt.
Edward Calvin Ferriday,	Clas.,	South Bethlehem.
Walter Ferris,	M.E.,	Wilmington, Del.
Curtis Bertram Flory,	E.E.,	Scranton.
†Clarence Richard Fountain,	E.E.,	Good Hope, D. C.
George Lane Gabrio,	E.E.,	Hazleton.
Andres Garza Galan,	C.E.,	Saltillo, Mex.
*Eduardo Antonio Giberga,	M.E.,	Matanza, Cuba.
John Jameson Gibson,	E.E.,	York.
Elmer Grant Godshalk,	A.C.,	Lansdale.
Wallace Russell Goss,	C.E.,	Union, S. C.

* Not clear of conditions.
† Excused.

	Course.	Residence.
William Heald Groverman,	M.E.,	Oakland, Md.
*Frederick Taylor Haines,	C.E.,	Elkton, Md.
*Thomas Graham Hamilton,	E.E.,	Pittsburgh.
†Robert Rieman Harvey,	E.E.,	Wilkes-Barre.
Thomas Lloyd Henry,	C.E.,	Troy, N. Y.
*Howard Samuel Hess,	Clas.,	Hellertown.
Ira Miller Higbee,	C.E.,	Watsontown.
William Hopkins,	E.E.,	Washington, D. C.
*Edgar Alonzo Houston,	C.E.,	Bellvale, N. Y.
Drew William Irvine,	E.E.,	Columbia, Tenn.
Elmer Augustus Jacoby,	Clas.,	Locust Valley.
William Agassiz James,	E.M.,	Wilkes-Barre.
Henry Scudder Jaudon,	C.E.,	Savannah, Ga.
Albert Beardsley Jessup,	E.E.,	Scranton.
Elisha Barton John,	C.E.,	Bloomsburg.
Victor Albert Johnson,	E.M.,	St. Paul, Minn.
Henry Harrison Jones,	C.E.,	Reading.
Adolph Somers Kappella,	E.E.,	Philadelphia.
Dixon Kautz,	L.S.,	Moweaqua, Ill.
Warren Byron Keim,	C.E.,	Reading.
Henry Edward Kip,	Arch.,	Buffalo, N. Y.
David Henshey Lackey,	E.E.,	Altoona.
William Allen Lambert,	Clas.,	Hellertown.
Louis Edgar Lannan,	E.E.,	Washington, D. C.
Arthur Hughes Lewis,	E.M.,	Plains.
*Gerald Lewis,	A.C.,	Milford.
Benjamin W. Loeb,	A.C.,	Reading.
Philip Theodore Lovering,	E.E.,	Minneapolis, Minn.
Robert A. McKee,	M.E.,	Towanda.
Fayette Avery McKenzie,	Sci.,	Montrose.
Stuart Tuttle McKenzie,	C.E.,	Montrose.
Norman Peach Massey,	C.E.,	Chestertown, Md.
Charles Frazier Maurice,	C.E.,	Athens.
John Samuel Miller,	M.E.,	Harrisburg.
*Archibald D. Morris,	M.E.,	Bristol.
Eugene Mowlds,	C.E.,	West Conshohocken.

*Not clear of conditions.
† Excused.

	Course.	Residence.
William Spencer Murray,	E.E.,	Annapolis, Md.
Robert Neilson, Jr.,	C.E.,	Williamsport.
Walter R. Okeson,	C.E.,	Bethlehem.
Charles B. Pennell,	M.E.,	Duncannon.
James Harry Philips,	C.E.,	Atglen.
Joseph Philips, Jr.,	E.M.,	Nashville, Tenn.
Wilbur Orton Polhemus,	C.E.,	Valley Cottage, N. Y.
*John Livingston Poultney,	M.E.,	Baltimore, Md.
*Edward Christopher Price,	A.C.,	Centreville, Md.
Henry Crider Quigley,	E.E.,	Harrisburg.
Homer Austin Reid,	C.E.,	Warren, O.
William Reinecke, jr.,	E.E.,	Louisville, Ky.
Eugene Jesse Rights,	C.E.,	Tahlequah, Ind. Ty.
Herbert Timothy Rights,	C.E.,	Tahlequah, Ind. Ty.
Clement Clarence Rutter,	C.E.,	Lansford.
Harry Kent Seltzer,	C.E.,	Ephrata.
John Egbert Shero,	A.C.,	Fredonia, N. Y.
*Luther D. Showalter,	C.E.,	Pottstown.
Robert S. Siegel,	Clas.,	Bethlehem.
*Edwin Harrison Sigison,	E.E.,	Buffalo, N. Y.
John Blake Slack,	E.E.,	Paducah, Ky.
Edward George Steinmetz,	E.E.,	Philadelphia.
John Eugene Stocker,	Sci.,	Bethlehem.
Robert Melvin Tarleton,	E.M.,	Baltimore, Md.
Robert Sayre Taylor,	Sci.,	Bethlehem.
*Walter Allison Thacher,	C.E.,	Camden, N. J.
Nathaniel Thurlow,	A.C.,	Lancaster.
Charles Frederick Townsend,	Arch.,	Willimantic, Conn.
Joseph Boyer Townsend,	E.E.,	Venetia.
*Frederick John Van Benthem van den Bergh,	C.E.,	Lyndon, Kan.
Willard Randolph Van Liew,	E.M.,	Neshanic, N. J.
*Geo. Brinkerhoff Van Riper,	A.C.,	Rutherford, N. J.
Charles Henry Vansant,	C.E.,	Eddington.
William Warr,	E.E.,	Philadelphia.
Harry Dallam Webster,	M.E.,	Baltimore, Md.
Fred Irving Wheeler,	C.E.,	Pawtucket, R. I.

* Not clear of conditions.

	Course.	Residence.
*William Gwilym Whildin,	E.M.,	Lansford.
Harry Amasa White,	E.E.,	Philadelphia.
John Crum Whitmoyer,	E.E.,	Harrisburg.
Edward Newton Wigfall,	A.C.,	Philadelphia.
John Marion Wilson,	C.E.,	Hillsboro, Md.
Harold L. Wood,	A.C.,	Upper Montclair, N.J.
Carlos Yglesias,	E.M.,	San José, Costa Rica,
Harry Bernard Zimmele,	A.C.,	Bethlehem. [C.A.

SOPHOMORE CLASS.

	Course.	Residence.
William James Adams,	E.E.,	Harrisburg.
William Stewart Ayars,	M.E.,	Wilkes-Barre.
Hobart Bentley Ayers,	M.E.,	Westerly, R. I.
Albert Doane Ayres,	C.E.,	Williamsport.
Arthur Davison Badgley,	E.E.,	South Bethlehem.
*Francis Hoskins Baldwin,	E.E.,	Atlantic City, N. J.
Hasell Wilson Baldwin,	M.E.,	Cambridge, O.
Lewis Warrington Baldwin,	C.E.,	Waterbury, Md.
Springfield Baldwin,	C.E.,	Baltimore, Md.
*Charles Herbert Barker,	E.E.,	Morant Bay, Jamaica.
Geo. Pomeroy Bartholomew,	E.M.,	Jeanesville.
Frederic Bartles,	C.E.,	Williamsport.
Charles C. W. Bauder,	E.E.,	Rheims, N. Y.
Fairfax Bayard,	C.E.,	Washington, D. C.
James George Beach,	Arch.,	Apalachin, N. Y.
Herbert Huebener Beck,	A.C.,	Lititz.
Samuel Edward Beeler,	M.E.,	Hagerstown, Md.
Edgar Tweedy Belden,	C.E.,	Stamford, Conn.
William W. M. Bending,	C.E.,	Philadelphia.
Moriz Bernstein,	C.E.,	Philadelphia.
Warren Joshua Bieber,	Clas.,	Bethlehem.
Daniel William Bliem,	C.E.,	Pottstown.
Lawrence Leander Borden,	C.E.,	Fall River, Mass.
Benjamin Franklin Bossert,	C.E.,	Phœnixville.
Howard Franklin Boyer,	Sci.,	Springtown.

* Not clear of conditions.

	Course.	Residence.
Edward Elisha Bratton,	C.E.,	Lewistown.
Frank Shepard Bromer,	M.E.,	Schwenksville.
Maximilian Joseph Bucher,	A.C.,	Columbia.
George Buckman,	E.E.,	Penn Valley.
George Amandus Buvinger,	M.E.,	Dayton, O.
Aaron Beaumont Carpenter,	E.E.,	Avondale.
Malcolm Carrington,	E.E.,	Richmond, Va.
Frank Leslie Cooke,	E.E.,	Hackettstown, N. J.
Eckley Samuel Cunningham,	M.E.,	Drifton.
Samuel Philip Curtis,	M.E.,	Penn Yan, N. Y.
Frederick Allyn Daboll,	C.E.,	Plainfield, N. J.
John William Dalman,	M.E.,	Fort Wayne, Ind.
Lewis Benjamin Davenport,	C.E.,	Baltimore, Md.
*Charles Stanley Davis,	E.M.,	Reynoldsville.
Paul Benjamin Davis,	A.C.,	Reading.
Eckford Craven DeKay,	C.E.,	New York City.
Samuel Moses Dessauer,	Arch.,	Montrose.
William Carter Dickerman,	M.E.,	Milton.
George Armstrong Dornin,	M.E.,	Norfolk, Va.
Frank Oliver Dufour,	C.E.,	Mitchellsville, Md.
Lewis Stokes Duling,	C.E.,	Philadelphia.
Edward Miall Durham, jr.,	C.E.,	Vicksburg, Miss.
*Edward Hiram Dutcher, jr.,	M.E.,	Bridgeport, Conn.
Timothy Sharpe Eden,	E.E.,	Brown's Town, Jamaica.
George Ramsey Enscoe,	C.E.,	Bennett P. O.
William Alvin Evans,	E.M.,	Summit Hill.
Charles Victor Ferriday,	M.E.,	South Bethlehem.
*Charles Albert Andrew Fink,	M.E.,	Yonkers, N. Y.
Thomas Joseph Gannon,	M.E.,	South Bethlehem.
James Brown Given,	E.E.,	Carlisle.
John Edgar Gomery,	C.E.,	Lehighton.
John Savage Graff,	E.M.,	Williamsport.
*William Morris Greenwood,	M.E.,	Bethlehem.
David Hall,	E.E.,	Fayetteville, Tenn.
Robert Graham Hengst,	E.E.,	Pittsburgh.
Harry N. Herr,	C.E.,	Wheatland Mills.
Howard Drysdale Hess,	M.E.,	Philadelphia.

* Not clear of conditions.

	Course.	Residence.
*Norman M. Holmes,	C.E.,	Stroudsburg.
Oliver Zell Howard,	M.E.,	Hagerstown, Md.
Robert Parsons Howell,	C.E.,	Blairstown, N. J.
†William Thomas Hutchins,	C.E.,	Wyoming.
*James Madison Jackson,	M.E.,	Parkersburg, W. Va.
William Steell Jackson,	E.E.,	Duncannon.
*Harvey B. Johnson,	A.C.,	South Bethlehem.
†Leroy Allen Kendall,	M.E.,	Buffalo, N. Y.
*James Keys,	C.E.,	Conshohocken.
Victor Witmer Kline,	C.E.,	Lockport, N. Y.
Robert Edwin Kresge,	A.C.,	South Bethlehem.
Robert Edward Laramy,	Clas.,	Bethlehem.
Ernest Tisdel Lefevre,	E.M.,	Panama, U. S. Col.
Robert Pierce Lentz,	M.E.,	Lehighton.
Telford Lewis,	E.M.,	Blairsville.
*Sterling Catlin Lines,	E.E.,	Wilkes-Barre.
Charles Victor Livingston,	E.E.,	Kingston. N. Y.
Bruce Emerson Loomis,	E.E.,	Wilkes-Barre.
Caleb Wheeler Lord,	M.E.,	Lebanon.
Clifford Sherron MacCalla,	E.E.,	Philadelphia.
James Gordon Mason,	E.M.,	West Pittston.
Victor Emanuel Masson,	A.C.,	Hammondsport, N. Y.
*Esteban Angel Mercenario,	M.E.,	Vera Cruz, Mex.
†William Alfred Merritt,	M.E.,	Baltimore, Md.
*George Roberts Michener,	E.M.,	Germantown.
Edward Williamson Miller,	E.M.,	Bethlehem.
Elmer Wesley Mitchell,	C.E.,	Fall River, Mass.
Rafael de la Mora,	M.E.,	Guadalajara, Mex.
Charles Howard Morgan,	E.E.,	Maxatawny.
William Hitz Mussey,	E.E.,	Washington, D. C.
John Henry Myers,	C.E.,	Lewistown.
John Buckley McBride,	C.E.,	Deckertown, N. J.
*Ellicott McConnell,	M.E.,	Philadelphia.
Burt Melville McDonald,	C.E.,	Springfield, Mass.
Harvey Frankenfield Nase,	C.E.,	Springtown.
Franklin Oberly,	E.E.,	Bethlehem.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Louis Atwell Olney,	A.C.,	Providence, R. I.
*Miles Hallacker Orth,	C.E.,	Williamsport.
Horace Lucius Palmer,	C.E.,	Frenchtown, N. J.
Harry Richards Peck,	M.E.,	Scranton.
†Charles Warren Pettit,	C.E.,	Elmira, N. Y.
Edward Arlington Pittis,	C.E.,	Washington, D. C.
Morris Wright Pool,	M.E.,	Washington, D. C.
*Godwin Hall Powell,	E.M.,	Llanidloes, Wales.
Morris Havens Putnam,	E.E.,	Tioga.
James Lee Rankin, jr.	M.E.,	Savannah, Ga.
Henry Paul Reed,	E.E.,	New London, Conn.
John David Richards,	C.E.,	Columbus, Miss.
Chester Dawson Richmond,	E.E.,	Chattanooga, Tenn.
George Brydges Rodney,	C.E.,	New Castle, Del.
Antonio M. Ros-y-Jané,	M.E.,	Guantanamo, Cuba.
*George Homer Ruggles,	C.E.,	Cherokee, Iowa.
Auguste Leopold Saltzman,	M.E.,	Plainfield, N. J.
John Cornelius Sesser,	C.E.,	Saint Joseph, Mich.
Arthur Yeager Shepherd,	M.E.,	Wilkes-Barre.
Henry Shriver, jr.,	M.E.,	Cumberland, Md.
*Joseph Henry Siegel,	E.M.,	Salt Lake City, Utah.
John Thomas Simpson,	Arch.,	Kittanning.
*Jonathan Edward Slade,	C.E.,	Chicago, Ill.
Harvey Wilson Sprague,	M.E.,	Bethlehem.
*Alvin Riegel Sterner,	E.E.,	Bethlehem.
Ambrose B. Strickler,	M.E.,	Waynesboro.
Edward Ernest Taylor,	M.E.,	Ft. Wayne, Ind.
William Bailey Taylor,	E.E.,	Bethlehem.
John Augustus Thomson,	E.M.,	Summit Point, W. Va.
Edward Coppée Thurston,	E.M.,	South Bethlehem.
Joseph Wharton Thurston,	Clas.,	South Bethlehem.
*William Tidball,	E.E.,	New York City.
Curtis Edward Trafton,	E.E.,	Fall River, Mass.
Harry Conklin Tripp,	M.E.,	Millerton, N. Y.
George Brinton Van Brunt,	C.E.,	Long Branch, N. J.
Charles Parker Wagoner,	C.E.,	Phœnixville.

* Not clear of conditions.
† Excused.

	Course.	Residence.
John Scofield Wallace,	E.M.,	New Castle.
U. Grant S. Walters,	C.E.,	Pottstown.
John Eugene Weideman,	E.E.,	Washington, D.C.
Frank Thomas Weiler,	C.E.,	Pequea.
Allan Hart Whiting,	E.E.,	New York City.
*Davis S. Williams,	C.E.,	Fort Snelling, Minn.
David William Wilson, jr.,	Arch.,	Brooklyn, N. Y.
Jay Roberts Wilson,	E.E.,	Bethlehem.
Arthur Romain Womrath,	M.E.,	Pottsville.
George Fred. Y. Womrath,	E.E.,	Pottsville.
Alfred Mahlon Worstall,	E.E.,	Millville, N. J.
Hubert Harris Wright,	E.E.,	Cambridge, Md.
Frank S. Young,	E.M.,	Plymouth Meeting.
Ignacio Maria Zertuche.	E.M.,	Matehuala, Mexico.

FRESHMAN CLASS.

	Course.	Residence.
Harry Leigh Adams,	E.E.,	Washington, D. C.
Alfred Reginald Allen,	E.E.,	Bethlehem.
*Llewellyn Allport,	C.E.,	Philipsburg.
†Juan de Dios Amador,	M.E.,	Panama, U. S. Col.
Francis DuPont Ammen,	M.E.,	Ammendale, Md.
Henry Jonathan Biddle Baird,	A.C.,	West Chester.
Lathrop Hutchings Baldwin,	M.E.,	Allentown.
Charles Marshall Barton,	C.E.,	Pikesville, Md.
Richard Becerra, jr.,	A.C.,	New York City.
Frank Breckenridge Bell,	E.E.,	Mercer.
William Ragan Binkley,	E.E.,	Hagerstown, Md.
Thomas Hally Bissell,	E.E.,	Buffalo, N. Y.
Oliver F. Bitting,	E.E.,	South Bethlehem.
Francis Jos. Blickensderfer,	E.E.,	Bethlehem.
Henry Clay Borden,	E.M.,	Philadelphia.
Bertine Frederick Borhek,	E.E.,	Bethlehem.
†Wm. Lebbeus Bosbyshell,	E.E.,	Philadelphia.
Charles Schwartze Bowers,	E.E.,	Philadelphia.
Frank Austin Boyer,	E.M.,	Pine Grove.
John Boyt,	E.M.,	Clifton Heights.

*Not clear of conditions.
† Excused.

	Course.	Residence.
William Burke Brady,	M.E.,	Harrisburg.
Daniel John Broughal,	A.C.,	South Bethlehem.
Horatio Francis Brown,	M.E.,	Baltimore, Md.
Robert Berdell Cable, jr.,	M.E.,	Bethlehem.
†Edgar Carbonne y Reyes,	M.E.,	Havana, Cuba.
*David J. Castilla,	M.E.,	Coahuila, Mex.
Amado Cavazos,	M.E.,	Saltillo, Mex.
Greenleaf Howe Chasmar,	E.E.,	Brooklyn, N. Y.
Thomas Holland Clagett,	E.M.,	Berryville, Va.
Thomas Micks Clinton,	E.E.,	Baltimore, Md.
†George Henry Cox, jr.,	E.E.,	Towanda.
Barton Olmsted Curtis,	C.E.,	Iowa City, Iowa.
Patrick Edward Dinan,	A.C.,	South Bethlehem.
Louis Diven,	E.E.,	Elmira, N. Y.
Henry John Downs,	Arch.,	Steelton.
William Kuhn Dunbar,	C.E.,	Pittsburgh.
Stuart Rhett Elliott,	E.E.,	Beaufort, S.C.
John Agustus Fisher,	E.M.,	Huntingdon.
Willard Boyer Fuller,	M.E.,	Catasauqua.
Ira D. Fulmer,	E.E.,	Richland Centre.
Archibald S. Furtwangler,	C.E.,	Greensburg.
Orrin S. Good,	E.E.,	Lock Haven.
Ralph Scofield Griswold,	E.E.,	Madison, N. J.
John Lewis Gross,	M.E.,	Allentown.
Frank Hammond Gunsolus,	Arch.,	Tipton, Iowa.
Hugh Ellmaker Hale,	C.E.,	Philipsburg.
Charles Edwin Hammond,	C.E.,	Geneva, N. Y.
William Thomas Hanly,	C.E.,	Philadelphia.
*Erle Reiter Hannum,	E.E.,	Pottsville.
*George Duncan Heisey,	E.M.,	Pittsburgh.
William Stephen Hiester,	E.E.,	Elmira, N. Y.
Ross Nathaniel Hood,	E.E.,	Duncannon.
Edward Smith Illig,	E.E.,	Reading.
Henry Taylor Irwin,	M.E.,	Allegheny.
Ambrosio E. Jane-y-Montoya,	M.E.,	Guantanamo, Cuba.
*Philip H. Janney,	M.E.,	Baltimore, Md.
Arthur Perkins Jenks,	E.E.,	Philadelphia.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Harry Sackett Johnson,	E.E.,	East Aurora, N. Y.
Edward Joseph Kehoe,	E.E.,	South Bethlehem.
*Duncan Kennedy, jr.,	E.E.,	Newport, R. I.
Edwin Fitzgerald King,	E.E.,	Washington, D. C.
†Charles Henry Knight,	Clas.,	Bethlehem.
Edward Steckel Knisely,	M.E.,	Bethlehem.
Lewis Daniel Kreidler,	A.C.,	Bath.
Lawrence Rust Lee,	M.E.,	Shepherdstown, W. [Va.
†John George Lehman,	M.E.,	Bethlehem.
Arthur Frost Loomis,	E.E.,	Oneida, N. Y.
*Robert Meyers Luckenbach,	A.C.,	Bethlehem.
Owen Gray MacKnight,	E.E.,	Plains.
Barry MacNutt,	E.E.,	Bethlehem.
Louis Alphonsus Marck,	E.E.,	Bradford.
Lee Holmes Marshall,	M.E.,	Pittsburgh.
William A. Megraw,	M.E.,	Baltimore, Md.
Thaddeus Merriman,	C.E.,	South Bethlehem.
Davis Levis Moore, jr.,	E.E.,	Philadelphia.
Charles R. W. Morison,	E.E.,	Ilchester, Md.
Frank Douglass Mount,	C.E.,	Manasquan, N. J.
*James Francis McCabe,	C.E.,	Baltimore, Md.
*George K. McGunnegle,	E.E.,	Meadville.
†Daniel Francis McKee,	E.M.,	Bethlehem.
Carl Pivany Nachod,	E.E.,	Philadelphia.
*Charles G. Newton,	C.E.,	Guadalajara, Mexico.
Henry H. Newton,	M.E.,	Guadalajara, Mexico.
Robert Collyer Noerr,	C.E.,	Washington, D. C.
Charles Carroll O'Donnell,	C.E.,	Connellsville.
John O'Reilly,	A.C.,	South Bethlehem.
James Harkins Pennington,	M.E.,	Yerkes.
William Lindley Pettit, jr.,	C.E.,	Fort Wayne, Ind.
*Clarence Marion Pflueger,	M.E.,	Seidersville.
Samuel Jackson Randall,	Sci.,	South Bethlehem.
John Peake Reynolds, jr.,	M.E.,	Charleston, S. C.
Samuel Stewart Riegel,	M.E.,	South Bethlehem.
Carl John Roelker,	E.E.,	Washington, D. C.
E. P. Roundey,	C.E.,	East Orange, N. J.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Woodford Royce,	M.E.,	Willimantic, Conn.
Wallace Edgar Ruhe,	E.E.,	Allentown,
Henry Felthousen Russell,	M.E.,	Buffalo, N. Y.
*Rafael Francisco Sanchez,	E.M.,	Mantanzas, Cuba.
Benjamin Franklin Sawtelle,	E.E.,	Bethlehem.
Charles Francis Scott,	M.E.,	New York City.
Henry Hamilton Seabrook,	E.E.,	Beaufort, S. C.
Samuel Palmer Senior,	C.E.,	Washington, D. C.
Arthur Harold Serrell,	E.E.,	Plainfield, N. J.
†Gwynne Harris Sharrer,	E.E.,	Washington, D. C.
*Frank Bradley Sheaffer,	C.E.,	New Bethlehem.
Charles Shimer,	M.E.,	West Bethlehem.
*Edward Peter Shuman,	C.E.,	Alllentown.
Joseph Israel Seigfried,	A.C.,	South Bethlehem.
*Michael T. Eagan Stack,	C.E.,	Shenandoah.
*Joseph Eby Stott,	E.E.,	Lancaster.
Paul Beno Straub,	E.E.,	Allegheny.
*Winfred A. Stubblebine,	M.E.,	Bethlehem.
Jack F. Symington,	M.E.,	Baltimore, Md.
*Harry Wellington Thatcher,	A.C.,	South Bethlehem.
Columbus William Thorn,	C.E.,	Washington, D. C.
*William Franklin Transue,	M.E.,	South Bethlehem.
Wallace Treichler,	C.E.,	Elizabethtown.
Harry Carpenter Tschudy,	C.E.,	Smyrna, Del.
William Edward Underwood,	E.E.,	Lancaster.
Harrison Ricord Van Duyne,	C.E.,	Newark, N. J.
*Geo. Frederick Vowinckel,	E.E.,	Clarion.
James F. Wallace,	M.E.,	New Castle.
Edward Hileman Waring,	M.E.,	Plainfield, N. J.
Clarence Earl Weaver,	E.E.,	Bradford.
Frederick Charles Wettlaufer,	A.C.,	Hoboken, N. J.
Gilbert Case White,	E.E.,	Richmond, Va.
Isidore Herman Wiesenberg,	A.C.,	South Bethlehem.
William Bell Wood,	M.E.,	Baltimore, Md.
Warren Worthington,	E.E.,	Rush Valley.
George Livingston Yates,	E.E.,	Carlisle.
Ambrose Everett Yohn,	M.E.,	Saxton.

* Not clear of conditions.
† Excused.

SPECIAL STUDENTS.

George William Bird, B.A.,	E.M.,	Freeland.
*Samuel William Briscoe,	E.M.,	Baltimore, Md.
Clarence A. Crane,	M.E.,	New York City.
William Jacob Hiss, jr.,	E.E.,	East Orange, N. J.
*William Sprague Maharg,	A.C.,	Bethlehem.
*Chauncey Matlock,	E.E.,	Brooklyn, N. Y.

SUMMARY OF STUDENTS BY STATES.

Vermont,	1
Massachusetts,	7
Rhode Island,	5
Connecticut,	6
New York,	43
New Jersey,	35
Pennsylvania,	275
Delaware,	5
Maryland,	40
District of Columbia,	23
Virginia,	9
West Virginia,	5
North Carolina,	3
South Carolina,	5
Georgia,	2
Alabama,	1
Mississippi,	3
Kentucky,	3
Tennessee,	5
Ohio,	6

Indiana,	3
Illinois,	6
Michigan,	1
Minnesota,	3
Iowa,	3
Kansas,	2
Utah,	1
Indian Territory,	2
Oklahoma Territory,	1
Nova Scotia,	1
Mexico,	8
Cuba,	5
Jamaica,	3
Porto Rico,	1
Costa Rica,	1
U. S. of Colombia,	2
Wales,	1
Japan,	1
	527

SUMMARY OF STUDENTS BY CLASSES AND COURSES.

	Graduates.	Seniors.	Juniors.	Sophomores.	Freshmen.	Specials.	Totals.
Classical,	4	1	6	3	1	—	15
Latin-Scientific,	1	—	1	—	—	—	2
Science and Letters,	—	—	3	1	1	—	5
Civil Engineering,	5	24	46	45	24	—	144
Mechanical Eng.,	3	20	18	38	35	1	115
Mining Eng.,	1	9	15	16	8	2	51
Electrical Eng.,	3	23	30	34	49	2	141
Analytical Chem.,	5	7	11	7	11	1	42
Architecture,	2	2	2	4	2	—	12
Totals,	24	86	132	148	131	6	527

THE LEHIGH UNIVERSITY.

ORIGIN.

The Hon. Asa Packer, of Mauch Chunk, during the year 1865, appropriated the sum of $500,000, to which he added one hundred and fifteen acres of land in South Bethlehem, to establish an educational institution in the rich and beautiful Valley of the Lehigh. From this foundation rose The Lehigh University, incorporated by the Legislature of Pennsylvania in 1866. In addition to these gifts, made during his lifetime, Judge Packer by his last will secured to the University an endowment of $1,500,000, and to the University Library one of $500,000.

DESIGN.

The original object of Judge Packer was to afford the young men of the Lehigh Valley a complete education, technical, literary, and scientific, for those professions represented in the development of the peculiar resources of the surrounding region. In furtherance of this purpose instruction is liberally provided in Civil, Mechanical, Mining, and Electrical Engineering, Chemistry, Metallurgy, Architecture, and in all needful collateral studies. A School of General Literature is also established and thoroughly equipped, with three departments, called respectively the Classical, the Latin-Scientific, and that of Science and Letters. These departments are kept up to the standard, and the requirements for entrance are the same as those of our best Classical and Literary institutions.

TUITION.

The following charges are made for tuition:

For students in the Technical courses, $100 per annum: $40 for the first term, $60 for the second term; for stu-

dents in the school of General Literature, $60 per annum: $25 for the first term, $35 for the second term.

These fees include all tuition, with the use of the Library and Gymnasium, but the student is charged for materials and apparatus consumed in the Laboratories.

The Trustees have placed at the disposal of the Faculty a number of free scholarships, to be awarded to applicants of good moral character who shall pass the entrance examinations creditably, and who for other cause shall be regarded as worthy by the Faculty.

Applications for these free scholarships should be made to the President of the University.

All fees for tuition are payable to the Treasurer of the University within thirty days after the opening of the term.

PUBLIC WORSHIP.

Prayers are held in the Packer Memorial Church of the University every morning and all students are required to be present.

Divine service is held every Sunday morning in the church. The service is according to the forms of the Protestant Episcopal Church, under whose auspices the University was placed by its Founder. Attendance is required of every student, except in case of those connected with other religious bodies, to whom the President will grant permission at the beginning of each term (if requested by the parent or guardian, or by the student himself if he be 21 years of age) to attend during that term the place of worship of the body with which he is connected, where attendance on Sunday morning will be required.

SITE.

The situation of the institution is healthful and beautiful. The region is famous for its railway and manufacturing enterprises; it possesses some of the richest iron and coal mines in our land, and thus gives the students rare

facilities for confirming the teachings of the recitation room by the observation of the eye.

The University buildings are about a half-mile from the depot, at the junction of the Lehigh Valley and North Pennsylvania Railroads. New York is ninety-two and Philadelphia fifty-seven miles distant.

BUILDINGS.

PACKER HALL,

named after the Founder, stands seven hundred feet back of Packer Avenue, at the base of the South Mountain. It is built of stone, and contains lecture and recitation rooms, the drawing rooms, and the museum of geology and natural history.

THE CHEMICAL LABORATORY

is thoroughly fire-proof, is built of sandstone, and is 219 feet in length by 44 in width.

There are two principal stories and a basement. The upper floor is occupied by the quantitative and the qualitative chemical laboratories, the former accommodating 48 and the latter 84 students. These rooms are 22 feet in height, and are well lighted and ventilated. A laboratory for industrial chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a recitation room, a chemical museum, and laboratories for organic, physiological, agricultural, and sanitary chemistry.

In the basement is the large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis, also rooms containing the apparatus for several processes in industrial chemistry, the engine and air-pump for vacuum filtration, a store room, and the toilet.

A photographic laboratory is located in the third story of the central portion of the building.

THE METALLURGICAL LABORATORY

contains a lecture room, a blowpipe laboratory for class instruction in blowpipe analysis and in the practical determination of crystals and minerals, a museum for mineralogical and metallurgical collections, a mineralogical laboratory provided with a Fuess reflecting goniometer, a polariscope, a Groth's "universal apparat," and a Rosenbusch polarizing microscope, a dry laboratory provided with furnaces for solid fuel and for gas with natural draught and with blast, and a wet laboratory for ordinary analytical work. It is arranged for the instruction of classes in the courses of mineralogy, metallurgy, and blowpipe analysis of the regular curriculum, and to afford facilities to a limited number of advanced students for familiarizing themselves with the methods of measurement and research employed in mineralogy and metallurgy, and for conducting original investigations in these departments of science.

THE NEW PHYSICAL LABORATORY.

This building has been finished and is now in use. It is of stone, 235 feet in length, and 4 stories in height. The first or ground floor is devoted to electrical work, and forms the Senior Electrical Laboratory. It contains a large dynamo room, with the engine, dynamos, and motors, with all their appliances; battery, balance, calorimetric rooms and workshops. The eastern part of this story has been carefully arranged for delicate work. The use of iron has been avoided; the gas and steam mains and pipes, radiators, etc., are all of brass. In this section are seven special rooms for investigations of the magnetic properties of iron and original research. A hall over 200 feet in length can be darkened and utilized for long range work in testing lamps. Under this floor is the "cave" or even temperature room, completely enclosed with solid stone masonry. On this and the other 3 floors are private laboratories, store and apparatus rooms, and offices for instructors.

The second story contains the Junior Electrical Laboratory, 56 by 44 feet; the Mechanical Laboratory, 60 by 44

feet, with tables for 80 students, the Library, a time and two balance rooms, with floors resting on solid stone arches.

On the third floor is a public hall, 70 by 44 feet, for examinations; also the professor's lecture room, 40 by 44 feet, with private laboratories, etc.

On the fourth floor in the west wing are two recitation rooms for the instructors, 40 by 18 feet, and the Heat Laboratory, 44 feet square, with tables for 72 persons. On the east side is the Light Laboratory. This contains one room with tables for 40 persons, and 8 smaller dark rooms, each of which can be divided into two parts. Besides these are 4 photographic dark rooms, 8 by 28 feet, each with all the necessary equipments.

The tower, which is devoted to meteorological purposes, has two stories of one room each, 16 by 21 feet, with a vane room above. Besides these there are several small rooms for special purposes scattered among the four floors.

The tendency in the latest and best Physical Laboratories is towards a larger number of smaller rooms, rather than to a few large rooms. It will be seen from this description that the advantages of this plan have been gained by the many smaller rooms that exist, while for general work the larger halls are provided.

Three staircases at the middle and the two ends of the building afford ample means of entrance and egress.

THE SAYRE OBSERVATORY.

Near Brodhead Avenue is the Sayre Observatory, the gift of Robert H. Sayre, Esq., of South Bethlehem, containing an equatorial and a zenith telescope, transit instrument, and astronomical clock.

THE PACKER MEMORIAL CHURCH

is the munificent gift of Mrs. Mary Packer Cummings, daughter of the Founder of the University. It is a large and magnificent Church, richly furnished and handsomely appointed in every particular. There is no more beautiful

Church edifice in the State and it is one of the noblest in all the land.

THE UNIVERSITY LIBRARY.

To the east of Packer Hall is the University Library, erected by the Founder in memory of Mrs. Lucy Packer Linderman, his daughter.

THE GYMNASIUM

is a handsome and spacious structure, built and equipped with the utmost thoroughness. It is furnished with the best patterns of gymnastic apparatus, besides Dr. Sargent's system of developing appliances. It is provided with hot and cold water; tub, sponge, and shower baths, and 389 clothes closets. Opportunities for recreation and amusement are provided in the bowling alleys. It is under the immediate care of a skilled and competent Director.

All students are required to undergo a physical examination before being allowed the use of the Gymnasium, and this examination will be repeated once each year during their stay at the University. The proper exercise is prescribed and is required of every student. These regulations are designed to promote the harmonious, symmetrical development of the individual student.

EXPENSES.

Books, materials, paper, pencils, materials used in the chemical laboratories, and drawing instruments are furnished by the student. Materials consumed in the chemical laboratories can be obtained from the University, their value being covered by a deposit made at the opening of that term in which the laboratory work is to be done.

Rooms and board can not be had in University buildings, but can readily be obtained in many private houses.

The following is an estimate of the necessary expenses for the collegiate year, clothing and traveling not included:

Tuition,		$100	$100
Board for 40 weeks,	from	160 to	200
Room-rent, with fuel and lights		40 "	80
Care of room and use of furniture,		5 "	20
Washing and incidentals.		20 "	40
Books, stationery, etc.,		25 "	50
Total,		$350 to	$490

(In the case of students in the School of General Literature, the totals will be $310 to $450.)

NOTE.—If clubs be formed the cost of board need not exceed $3.50 per week.

ADMISSION OF STUDENTS.

The Register is intended to give all necessary information concerning the admission of students. Application may be made to the President of the University if information is desired which is not given in the Register.

DATE OF EXAMINATIONS.

Examinations for admission to the University are held at the opening of each term, and also in June at the close of the academic year.

The examinations for 1894 will be on Tuesday and Wednesday, January 9 and 10, for admission to the second term; on Thursday, Friday and Saturday, June 21, 22 and 23, and on Saturday, Monday and Tuesday, September 8, 10 and 11, for admission to the first term. No other examinations for entrance will be held, except for good cause, and all applicants *must* be in attendance at 9 o'clock on the morning of the first day.

The examinations are held in June and September in the following order:

First Day.—English, 9 A.M.; Arithmetic, 11 A.M.; Physics, 2 P.M.; Latin and Roman History, 2 P.M.

Second Day.—Geometry, 8.30 A.M.; Physical Geography, 11.30 A.M.; Geography, 3 P.M.; United States History, 4 P.M.

Third Day.—Algebra, 8.30 A.M.; Greek and Greek History, 2 P.M.

Applicants for entrance who wish to present certificates from preparatory schools as an equivalent for the examinations in English, Geography, and U. S. History are required to hand them to the examiner at 8.15 on the morning of the first day.

The schedules of examinations for applicants for admission to the Freshman Class at the beginning of the second term and to the Sophomore Class at the beginning of the first term may be obtained from the Secretary of the Faculty. Examinations at other than the appointed times can not be granted without great inconvenience, and candidates so applying will be required to pay a fee of $5 into the Faculty's fund for the aid of indigent students.

CHARACTER OF THE EXAMINATIONS.

The examinations are rigorous and cover the entire ground laid down in the following scheme. They are all conducted in writing, supplemented by an oral examination at the option of the examiner.

Each candidate for admission must be at least sixteen years of age and must present a testimonial of good moral character from his last instructor, or from the school or institute to which he last belonged, or from some reputable citizen of the community in which he lives.

Candidates for admission to

THE CLASSICAL COURSE

are examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition. Candidates are required to write a composition of four hundred words upon a subject announced at the time. The subject in 1894 will be taken from one of the following works: Bunyan's Pilgrim's Progress, Shakespeare's Julius Cæsar, Tennyson's Ulysses, Scott's Ivanhoe. In 1895 a subject will be taken from one of the following: Longfellow's Evangeline, Scott's Kenilworth, Dickens' Nicholas Nickleby, Gray's Elegy in a Country Churchyard.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution*.

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures.

[Chauvenet's Geometry (four books) is recommended, that being the text-book used in the University.]

7. *Physical Geography.*

8. *Latin Grammar.*

9. *Cæsar*, four books of the Gallic war.

10. *Cicero*, six orations, including the four against Catiline.

11. *Vergil*, the first six books of the Æneid, including Prosody.

12. The translation, at sight, of passages from Cæsar and Cicero.

13. The translation of English into Latin. (As special importance is given this part of the examination, it is suggested to teachers that they connect exercises in making Latin, both oral and written, with all the studies of the preparatory course.)

14. *Roman History.*—Creighton, Pennell, or Myers.

15. *Greek Grammar.*

16. *Xenophon*, Anabasis, four books.

17. *Homer*, Iliad, first three books, including Prosody. The Catalogue of Ships may be omitted.

18. The translation, at sight, of a passage from some work of Xenophon.

19. *Greek History.*—Fyffe, Pennell, or Myers (pp. 152–357).

20. Writing Greek with accents.

The pronunciation of Greek according to the written accents is followed in the University, and it is desirable that students preparing to enter be taught this system.

Latin is pronounced according to the method generally known as the Roman Method.

THE LATIN-SCIENTIFIC COURSE.

Candidates for admission to this course must present the first fourteen of the above requirements, but substitute for the Greek sections (numbers 15–20 inclusive) the following:

21. *Geometry.*—Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles: these constituting the subject matter of Books Five and Six of Chauvenet's Geometry.

THE COURSE IN SCIENCE AND LETTERS.

Candidates for admission to this course are examined in all the subjects demanded of those entering the Latin-Scientific Course, except the Latin and Physical Geography sections (numbers 7–14 inclusive). They also present the following:

22. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; also Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory by the student and the calculation of problems arising in the work.]

THE SCHOOL OF TECHNOLOGY.

Candidates for admission to the Courses in Civil Engineering, Mechanical Engineering, Mining Engineering, Electrical Engineering, Chemistry, and Architecture are examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition. Candidates are required to write a composition of four hundred words upon a subject to be announced at the time. The subject in 1894 will be taken from one of the following works: Bunyan's Pilgrim's Progress, Shakespeare's Julius Cæsar, Tennyson's Ulysses, Scott's Ivanhoe. In 1895 a subject will be taken from one of the following: Longfellow's Evangeline, Scott's Kenilworth, Dickens' Nicholas Nickleby, Gray's Elegy in a Country Churchyard. It is recommended that candidates have a knowledge of Latin Grammar, although an examination in it is not required for any courses except the Classical and the Latin-Scientific.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution.*

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures. Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles; these constituting the subject matter of the first six books of Chauvenet's Geometry.

[Chauvenet's Geometry is recommended, that being the text-book used in the University.]

7. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; also Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory and the calculation of problems arising in the work.]

Division of Entrance Examinations.

Candidates for admission to the Freshman Class may pass all the examinations in June, or all in September, or partly in June and partly in September, or may take them in *two consecutive years.* In the latter case, for the Technical courses and the course in Science and Letters, candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, and Arithmetic. No credit will be given unless the candidate has passed satisfactorily in at least three subjects at one examination.

The examinations in Algebra, Geometry, and Physics must be passed in June or September of that year in which the candidate proposes to enter the University.

In the Latin-Scientific and Classical courses candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, Arithmetic, Physical Geography, Roman History, and Greek History. No credit will be given unless the candidate has passed at least four of the subjects at one examination.

The examination in Latin may also be divided, but no credit will be given unless the candidate has passed in at least three of the topics specified at one examination. The examinations in the remaining subjects must be passed in June or September of that year in which the candidate proposes to enter the University.

Candidates intending to enter the University in September are advised to present themselves for examination in June; if they are not fully prepared at that time they will receive credit for the examinations then satisfactorily passed.

CONDITIONAL ADMISSION.

A candidate failing to pass in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to his class conditionally, to make up his deficiencies by extra study. When they are made up, he will be received into full standing in his class.

SPECIAL STUDENTS.

Young men of advanced standing, who do not desire to take a full regular course, can enter and select special shorter courses, with the sanction of the Faculty; but in all cases satisfactory examinations must be passed upon the subjects required for entrance to the Freshman Class.

ADMISSION TO ADVANCED STUDIES.

Candidates for admission to advanced studies *in any course* are required to pass, *in addition to the entrance examinations for that course*, examinations in the work already done by the classes which they desire to enter. These examinations are held on the same days as those for entrance to the Freshman Class.

The additional subjects may be found in the program of studies.

A diploma showing that a degree has been conferred, or a certificate of studies taken at another College will be received, in so far as it covers the subjects required for entrance, in lieu of the *Primary Entrance Examinations only.*

ADMISSION TO THE POST-GRADUATE COURSE.

Students of this University who have taken their *first* degree, and others, on presenting a diploma of an equivalent degree conferred elsewhere, are admitted to advanced studies, according to the plan to be found in the Register under the general subject of Graduate Students.

PREPARATORY SCHOOL CERTIFICATES

are not accepted so as to dispense with the primary entrance examinations.

NOTE.—The acceptance of a certificate as evidence of proficiency in lieu of examination is at the discretion of each Professor as to the subjects in his department.

PROGRAM OF STUDIES,

Showing the number of exercises per week for each subject, and the Text-books used.

The following is presented as the general program of instruction, subject to such modifications from time to time as the Faculty may deem expedient, with the approval of the Trustees.

The names of the text-books studied are generally mentioned. The number of exercises per week in each subject is indicated by the figure in parentheses immediately following.

Two hours of drawing, three of work in the laboratory, or three of practice in the field, are regarded as equivalent to a recitation or lecture of one hour's duration.

SCHOOL OF GENERAL LITERATURE.

There are three courses in the School of General Literature of the University.

I. The Classical Course includes all that is prescribed in our best institutions for the degree of Bachelor of Arts (B.A.). It covers full instruction in Greek, Latin, English, French and German, Mathematics, Astronomy, Physics, Chemistry, Geology, Physiology, Hygiene, History, Psychology, Ethics, Philosophy, Political Economy, and Constitutional Law.

II. The Latin-Scientific Course differs from the first in omitting Greek, taking in its place an increased amount of the Modern Languages and of Mathematics. Students completing this course receive the degree of Bachelor of Science (B.S.).

III. The Course in Science and Letters, for which the same degree is given as for the last mentioned, contains no

Latin or Greek, but furnishes instead extended instruction in French and German, History, General Literature, Mathematics, and General Science.

Instruction in all of these courses is given both by recitations and by lectures.

DESCRIPTION OF THE COURSES.

GREEK.—During the first term of Freshman year the class reads several books of the Odyssey, giving attention to epic forms and syntax, to prosody and scanning and to Homeric antiquities and mythology. The work of the second term is directed toward a thorough acquaintance with the idiom and vocabulary of Attic prose, as a preparation for rapid reading. The Œconomicus and Symposium of Xenophon and the Crito of Plato are read during the term, with sight readings from the Memorabilia and the Apology; accompanied with discussions of domestic life at Athens. The work of the year includes a thorough review-drill on the principles of Greek accidence and syntax, and exercises in Greek prose composition are required, based, during the second term, on the reading done by the class. Greek history is studied throughout the year, with special reference to the development of political institutions.

The Sophomore class takes up, during the first term, the study of Herodotus. Selections are made with the purpose of illustrating the author's best style and at the same time of presenting, from the original sources, the history of certain interesting epochs; the reading, after some drill on the Ionic forms, being in large part at sight. During the second term the class reads one or two plays of Euripides, with attention to the history of Greek tragedy, the life of the author and the analysis of the drama read. The lyric meters are studied, with the aim of gaining a knowledge of the rhythmical and metrical principles of Greek poetry. During this term an elective course is offered, the subject being Greek oratory, with the reading of certain orations of Lysias or Demosthenes, or both.

The Junior year is devoted to a further study of the drama, selected plays of Sophocles, Aristophanes, and Æschylus being read during the year. Work is also done in the study of public and private antiquities, partly in lectures by the professor and partly in original investigation on allotted subjects by the students.

During the first term of the Senior year the class reads either selections from Thucydides, or one of the dialogues of Plato. The second term is in part devoted to the reading of selected odes of Pindar, with careful study of the history of Greek lyric poetry and of the life and work of Pindar in particular. The course concludes with a review of the history of Greek literature, intended to summarize and harmonize the fragmentary views of the general subject gained from the study of particular authors and departments of literature.

LATIN.—Much of the training in the Freshman year is devoted to laying a good foundation in Latin grammar and in the translation of English into Latin. The authors studied are used to illustrate both of these, and a large amount is read at sight in order to cultivate quickness and readiness in the student. Roman history is begun, accompanied with full comments and lectures upon points of interest. Collateral reading will also be recommended each year throughout the course. Cicero: De Senectute and De Amicitia or the Philippics, Livy, and the Odes and Epodes of Horace are read this year. With the last named, training is given in Latin meters.

During this and the following year courses of lectures will be given upon Roman antiquities in addition to a text-book. The topography of Rome with its remains, ancient life in its various aspects, and the other departments of archæology will be discussed, illustrated by the new and extensive set of over 3100 magic lantern slides which have been prepared for this purpose.

The Sophomore year completes the text-book on Roman history. Prose composition is continued, and the subject of Synonyms taken up in connection with it. Quintilian

(Bk. X) with Crowell's Selections from the Lyric Poets will be read in the first term, and in the second the Agricola and Germania, with selections from the Annals of Tacitus, together with sight reading. An elective in Plautus is offered during this term in addition.

In the Junior year, selected letters of Cicero and Pliny are read, followed by Persius and several plays of Terence. The history of Roman literature is entered upon in the second term.

The work in the Senior year opens with Lucretius, accompanied with lectures on Roman philosophy. The course in the second term this year includes the study of ancient Latin, using Allen's Remnants of Early Latin, supplemented by a series of lectures upon Latin grammar and the history of the development of the language, together with several lectures upon the history of classical philology. Characteristic poems by various authors will be read with full comment and training in the discussion of the literary and critical points which come up.

SANSKRIT.—An elementary course in this study, conducted by the Professor of Latin, is offered as an optional during the Senior year.

HEBREW.—An elementary course in Hebrew, conducted by the Chaplain, is offered as an optional study, open to Seniors and Juniors of the whole University.

ENGLISH.—During Freshman and Sophomore years, Rhetoric is studied, both with the aid of a text-book and through practical exercises. Careful training is given in essay writing throughout the course, and orations are written and delivered during Junior and Senior years. Excellence in Oratory is encouraged by the annual contest for the Alumni Prizes, held on the 22d of February and open to the Junior Class in all departments.

The Seniors receive instruction in the principles of versification and in extemporaneous discussion, and are required to write a critique of some work selected for their examination.

The history of English literature and the philological history of the English language are studied during Junior year. These are supplemented by a series of lectures, extending through the second term, on the relations of literature to history. The course is completed by a series of lectures on English and American literature, delivered during the second term of Senior year.

ANGLO-SAXON.—An optional course in this subject is offered in Senior and Junior years.

MODERN LANGUAGES.—The study of modern languages is obligatory from the first term of the Sophomore year up to the close of the course. The student elects either French or German, or both, if time permits.

French.—The grammar is begun, reading being introduced immediately. The comparative and historical relations of the French to the English, and the connection of both with the Latin are carefully explained. As soon as possible the student is emancipated from the reader and takes up, in a progressive way, the reading of different authors; preference being given to modern writers, because it is considered to be of the highest importance that he acquire the language as it is, as an instrument whereby further knowledge can be obtained.

In the class-room, the language taught is used by the teacher as much as possible, in order that the ear of the pupil may become accustomed to its sound. Dictation is also employed, in order to give training in spelling. The rules of grammar are taught by numerous written exercises. In the second term of the Junior year, compositions in French are required, upon subjects which have been previously explained in French, in order that the student may become acquainted with different expressions and forms of construction. Before entering upon the study of an author's works, his life and literary achievements are discussed in French, which is translated, if necessary. In the Senior year, twelve lectures are delivered upon the history of

French literature. In addition to this, lectures in French upon the most distinguished modern authors are given to advanced students.

A weekly conversation-class affords opportunity for this kind of practice; and in it the events of the day and various historical and literary topics are discussed. Private courses of reading are also suggested to those who desire it.

German.—The German course follows the same plan as that laid down for the French, both as regards the methods employed and the opportunities afforded. The relations of English and German are dwelt upon and also those which connect the two languages with the Indo-European family.

MATHEMATICS.—The mathematical work is carried on during the Freshman and Sophomore years as follows:

Freshman year, first term, Chauvenet's Geometry, four exercises per week.

Second term, Olney's University Algebra, plane and spherical trigonometry, including mensuration and use of logarithmic tables, together five exercises per week throughout the term.

Sophomore year, first term, Olney's General Geometry and Davies' Analytical Geometry, four exercises per week.

Second term, Olney's Differential and Integral Calculus, four exercises per week. This term's work is elective for the Classical Course.

ASTRONOMY.—This study is taken up during the first term of the Senior year, Young's General Astronomy being used as the text-book. There are three exercises a week, and visits to the observatory help to make the work interesting as well as profitable.

CHEMISTRY.—This study includes a complete course of lectures in Freshman year upon general inorganic chemistry, in which the principles of the science are fully covered. These are illustrated by experiments, and are sufficiently extended to enable a student who desires to pursue the subject further to take analytical chemistry as

an elective in the second term of the Sophomore year. The text-book used in connection with the lectures is Remsen's Inorganic Chemistry.

PHYSICS.—This important subject is presented in a course of lectures during the first term of the Sophomore year, three times a week. These are illustrated by means of the very complete apparatus of the physical laboratory. In the course in Science and Letters, the work in this branch is more extended and is identical with that given to the Civil and Mechanical Engineers. It occupies five hours a week in the first term, when heat, magnetism, and electricity are discussed. Throughout the second term, three hours a week are devoted to sound and light.

GEOLOGY.—In the second term of the Senior year, a course of lectures is given in connection with Le Conte's text-book. The general principles of the science are explained, and the theories of the formation and stratification of rocks, the successive periods of the development of the earth's crust, the extinct forms of life and similar questions are treated.

PHYSIOLOGY AND HYGIENE.—These subjects are taught in a course of lectures during the Freshman year.

HISTORY, POLITICAL SCIENCE AND LAW.—The study of history begins with a course in the political antiquities of Greece and Rome. [See the Departments of Greek and Latin.] This is followed by the study of an outline of universal history (with text-book), and this by a fuller study of the political history of recent times, especially of that of England and France. During the first term of Senior year, there is a course of lectures upon the period covered by Gibbon's Decline and Fall of the Roman Empire. This prepares the way for a course of lectures on the philosophy of history, in which it is sought to set forth the scientific methods of the study of history.

The course in history is accompanied and supplemented by courses of lectures on constitutional law with special

application to the Constitution of the United States; and also on international law.

Instruction is given by lectures on the elements of political economy. The student is made familiar with the facts, methods, and doctrines of the science, and is encouraged to form and present his own opinions.

LOGIC.—Junior Class, first term, two hours weekly. Textbook, Prof. Jevons' "Lessons in Logic," supplemented by occasional lectures and by references to more extended logical treatises, such as those of J. S. Mill, Sir William Hamilton, Archbishop Thompson, Baynes' Port Royal Logic, etc.

MENTAL AND MORAL PHILOSOPHY.—The work in this department will be conducted chiefly by lectures, interrupted by occasional examinations. The courses at present are the following:

Outlines of Physiological Psychology.—Junior Class, second term. These lectures are founded principally on Wundt's lectures on the same subject, given in the University of Leipzig in the Summer of 1888; Wundt's Grundzüge der Physiologischen Psychologie, James' Psychology, Baldwin's Handbook, Ladd's Elements of Physiological Psychology, Sully's Outlines of Psychology, Carpenter's Mental Physiology, Maudsley's Physiology and Pathology of the Mind, Bain's Mind and Body, etc., with references to the classical works of Lotze, Weber, Fechner, and Helmholtz.

The History of Philosophy.—Senior Class, both terms. First term, Ancient and Medieval Philosophy. Second term, Modern Philosophy. These lectures will include a statement of the conception and problems of philosophy, a brief sketch of the great ethnical religions, and of the history of Oriental philosophy. The philosophy of the Greeks will be treated in detail, with illustrations from the writings of the philosophers.

The history of medieval philosophy will be prefaced by a short description of the philosophical ideas underlying

Christianity, and it will contain an account of the more important Church Fathers and Schoolmen.

The history of modern philosophy will begin by tracing the effect on philosophical thought of the ideas contributed by the Renascence and by the Reformation. From Lord Bacon on, a detailed history of the great modern philosophical systems will be given, which will be continued to those of our own times, including Mr. Spencer.

CHRISTIAN EVIDENCES. — Senior Class, second term. Lectures on Christian evidences, which will endeavor to treat of the subject both from the side of natural science and from that of biblical criticism.

No complete course in Ethics has as yet been established, but the history of ethics is included in the history of philosophy.

THE COURSE IN SCIENCE AND LETTERS

substitutes the following for the Latin and Greek:

DRAWING.—In the first term of the Freshman year the student is instructed in elementary projections, shading, and lettering.

ZOÖLOGY AND BIOLOGY.—The study of these subjects covers one year, beginning with the second term of Sophomore year. The work begins with a description of the various animal functions, and is extended to the comparative anatomy and physiology of the organs in typical species. Systematic zoölogy is then completed and followed by practical biology.

CHEMISTRY. — In addition to the course in general chemistry described above, three exercises a week in qualitative analysis are taken in the second term of the Freshman year.

MINERALOGY.—Instruction in mineralogy is given to the students in the Course in Science and Letters throughout the Junior year. In the first term, they attend a course of lectures on crystallography, followed by a series of practical exercises in the determination of crystalline forms by the aid of models and natural crystals.

In the second term a course on the physical properties of minerals and on descriptive mineralogy, with the use of E. S. Dana's Text-Book of Mineralogy, is followed by practical exercises in the determination of minerals.

GEOLOGY.—The study of lithology is pursued in the first term of the Senior year, with laboratory practice, Williams' Lithology being used as the text-book. During the next term, the course given above is taken with the Classical and Latin-Scientific students.

THE CLASSICAL COURSE.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

Greek.—Homer: Odyssey. Prosody. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (3)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Pt. III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Greek.—Xenophon: Œconomicus. (3)

Latin.—Livy completed. Horace: Odes and Epodes. Composition and prosody. (4)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's French Reader. (2) Or *German.*—Brandt's Grammar. Lodeman's Manual of Exercises. Buchheim's Reader. (2)

Greek.—Herodotus. (3)

Latin.—Horace: Satires and Epistles. Composition. (2)

History.—History of Rome. (1) Antiquities.

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

French.—Grammar and reader (continued). (2) Or *German.*—Grammar, exercises, and reader (continued). (2)

History.—Weber's Outlines of Universal History. (2)

Greek.—Euripides: Medea. (3)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

In addition to the above exercises, four hours per week must be selected from the following elective studies:

Mathematics.—Differential and integral calculus: Olney. (4)

Greek.—Demosthenes: De Corona. (2)

Latin.—Plautus. (2)

French.—Grammar and reader. (2)

German.—Grammar and reader. (2)

Chemistry.—Stoichiometry and qualitative analysis (laboratory). (4)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Greek.—Sophocles: Electra. Antiquities. (3)

Latin.—Letters of Cicero and Pliny. (3)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Buchheim's Prose Composition. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Greek.—Aristophanes: Clouds. Æschylus: Prometheus. (3)

Latin.—Persius and Terence. History of Roman literature. (3)

Literature and History. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Sadler; Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French literature. (2) Or *German.*—Grammar. Readings in Lessing, Herder, Goethe, Schiller, etc., and contem-

porary authors. Compositions. Lectures on German literature. (2) Conversation class in both languages optional throughout the year.

Greek.—Plato: Phædrus. Greek philosophy. (2)

Latin.—Lucretius, with lectures. Roman literature. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

French.—Readings. Compositions. Lectures in French on modern French authors. (2) Or *German.*—Readings. Compositions. Lectures in German on modern German authors. (2)

Geology.—Lectures. Geikie. (2)

Greek.—Pindar: selected odes. Greek literature. (2)

Latin.—Cicero: De Officiis, with lectures. (2)

Lectures on American and English Literature. (2)

Essays and Original Orations.

Preparation of Thesis.

Gymnasium.

THE LATIN-SCIENTIFIC COURSE.

The Latin-Scientific Course, leading to the degree of Bachelor of Science (B.S.), is based on Latin without Greek.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

German.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (2)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (1) Study of Words. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

German.—Grammar. Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

Latin.—Livy (completed). Horace: Odes and Epodes. Composition and prosody. (4)

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German.—Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

Latin.—Horace: Satires and Epistles. Composition. (2)

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney. (4)

French.—Grammar. Reader (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

History.—Weber's Outlines of Universal History. (2)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

Latin.—Letters of Cicero and Pliny. (3)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)

German.—Readings (continued). Dictation. Compositions. (2)

Latin. — Persius, Terence. History of Roman literature. (3)

Literature and History. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History. — Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Lectures on French literature. (2)

German.—Readings (continued). Compositions. Lectures on German literature. (1) Conversation class in both languages optional throughout the year.

Latin.—Lucretius, with lectures. Roman literature. (2)

Essays and Original Orations.

Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

Geology.—Lectures. Geikie. (2)

Latin.—Cicero: De Officiis, with lectures. (2)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Lectures on American and English Literature. (2)
Essays and Original Orations.
Preparation of Thesis.
Gymnasium.

COURSE IN SCIENCE AND LETTERS.

The Course in Science and Letters, leading to the Degree of Bachelor of Science (B.S.), is designed for those who wish to pursue both scientific and literary studies without Latin and Greek. These being omitted, extended instruction is given in French and German, History, General Literature, Mathematics and General Science.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

German.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Elementary projections, shading and lettering. (2)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (2) Study of Words. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

History.—History of Greece. (2). History of Rome. (1)

German.—Grammar. Reader (continued). Bernhardt's Novelletten—Bibliothek, I. (3)

English.—Rhetoric. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German.—Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus. Olney. (4)

Physics.—Sound and light. Lectures and recitations. (3)

Zoölogy.—Lectures. Orton. (2)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

French.—Grammar. Readings (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. (2)

History.—Weber's Outlines of Universal History. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

Zoölogy.—Lectures on biology. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Compositions. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

Literature and History. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French Literature. (2)

German.—Readings (continued). Compositions. Lectures on German Literature. (1)

In both languages conversation class optional throughout the year.

Geology. — Williams' Lithology and laboratory practice. (2)

Essays and Original Orations.

Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Geology. — Historic and dynamic geology. LeConte. (3)

Lectures on American and English Literature. (2)

Essays and Original Orations.

Preparation of Thesis.

Gymnasium.

THE SCHOOL OF TECHNOLOGY.

This school includes seven distinct courses:

I. The Course in Civil Engineering.
II. The Course in Mechanical Engineering.
III. The Course in Mining Engineering.
IV. The Shorter Course in Mining.
V. The Course in Electrical Engineering.
VI. The Course in Chemistry.
VII. The Course in Architecture.

These have the same curriculum of studies for the first term of the Freshman year; except that students who propose to take the course in Mechanical Engineering or that in Analytical Chemistry are required to take German. After the first term the student follows the program of the course which he has selected.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Chauvenet's Geometry (completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

French.—Whitney's Practical French Grammar. Super's Reader. (3) Or *German.*—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Free-hand sketching and lettering. (2)

English.—Rhetoric. (2)

Essays.

Physiology and Health.—Lectures. (1)

Gymnasium. (2)

THE COURSE IN CIVIL ENGINEERING.

The special technical studies in this course may be grouped under the heads of Surveying, Applied Mechanics, Road and Railroad Construction, Bridge Design, and Hydraulic and Sanitary Engineering.

The work in Surveying extends over four terms and embraces land surveying, leveling, topography, triangulation, railroad reconnaissance and location, hydrography, and the elements of geodesy. A large equipment of transits, levels, and other surveying tools affords students the opportunity of becoming familiar with the instruments of different manufacturers. Much time is devoted to practice in the field and drafting room, each student being required to become proficient in the use of instruments, in taking field notes, and in map-drawing. Particular attention is paid to the execution of topographical surveys and maps by the best modern methods. Railroad maps and profiles are made from actual field location. During the Senior year there is done secondary triangulation work of a high order of precision.

The work in Applied Mechanics comprises the strength and elasticity of materials, the theory of the equilibrium of arches, roofs and bridges, that part of the mechanics of

machinery which relates to locomotives and hoisting machines, and the theory of hydraulics and hydraulic motors. Here the theoretical principles are illustrated by examples and problems taken as far as possible from actual engineering practice and a special report is required from each student on the testing machines of the Bethlehem Iron Company.

The course in Construction familiarizes the student with the qualities of materials used in engineering structures, with methods of preservation and testing, with masonry and foundations, and with the building and maintenance of roads and railroads. All the standard tests for hydraulic cements and mortars are made by each student.

The course in Bridge Design is preceded by the theory of computation of stresses by both analytical and graphic methods. Starting with the specifications for a first-class iron highway or railroad bridge, each student then makes the full computations, designs, working drawings and bills of material for a plate girder, a lattice girder, and a pin-connected truss bridge. The weight of the designed bridge is finally determined and compared with the dead load assumed for the calculations. The drawings are made and dimensioned in the same manner as in the drafting office of a bridge company. In connection with this course visits of inspection to bridges in the vicinity are regularly made.

The work in Hydraulic and Sanitary Engineering embraces the study of systems of water supply, the collection, purification and distribution of water, the combined and the separate systems of sewerage, the methods for the disposal of sewage, and the best practice for the drainage and ventilation of houses. The hydraulic laboratory in the University Park affords opportunity for experiments on the actual measurement of water by means of weirs and orifices, and the testing of hydraulic motors.

Besides these special studies there is a course in astronomy, which includes practical work in the observatory. The study of English, and of French or German, is con-

tinued, and instruction is given during four terms in crystallography, mineralogy, lithology, and geology.

The student who completes all the studies of this course will receive the degree of Civil Engineer (C.E).

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Construction.—Materials. Masonry. Carpentry. Roads and pavements. Sketches of structures. (2)

Drawing.—Descriptive geometry and isometric drawing. Tracings. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—Architectural drawing. Plans of piers and arches. Problems in stone cutting. (4)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and light. Lectures and recitations. (3)

French.—Grammar. George Sand: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus, and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Surveying.—Triangulation. Topographical surveying with transit and stadia. Use of plane table. Topographical map. (4)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Construction.—Foundations. Specifications and estimates. Reports on structures. Tests of cements. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. Lectures on construction and maintenance. (4)

Roofs and Bridges.—Theory and calculations of strains in roof and bridge trusses. Graphic statics. (5)

Construction.—Retaining walls, masonry dams and stone arches. Designs and estimates. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Astronomy.—Young's General Astronomy. (3)

Bridges.—Suspension, continuous, and cantilever bridges. Design of plate girders and riveted bridges, with working drawings. (6)

Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (3)

Mechanics of Machinery.—Pile drivers, cranes and elevators. The mechanics of the locomotive. (2)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (2)

Gymnasium.

SECOND TERM.

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Bridges.—Design of pin-connected bridges, with working drawings and estimates. (3)

Hydraulics.—Hydrostatics. Efflux of water from orifices and flow in pipes and rivers. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Hydraulic and Sanitary Engineering.—Collection, purification and distribution of water. Systems of water supply. The combined and the separate system of sewerage. Disposal of sewage. House drainage. (4)

Geology.—Historic and dynamic. Geikie. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN MECHANICAL ENGINEERING.

The object of this course is the study of the Science of Machines. The principal subjects taught are: The nature, equivalence, and analysis of mechanisms, the mechanics or theory of the principal classes or types of machinery, Mechanical Technology, and the principles and practice of Machine Design.

That the students may obtain the practical engineering data which they will most need when beginning their work as mechanical engineers they are required to pursue a course of Shop Instruction which does not necessarily involve manual labor and manipulation of tools, but is principally devoted to familiarizing them with those points in pattern-making, moulding, forging, fitting and finishing, which they need to know as designers of machinery. Particular attention is therefore directed to the forms and sizes of machine parts that can be readily constructed in the various workshops, to the time that it takes to perform, and the order of, the various operations, to the dimensions most needed by workmen and to the various devices for increasing the accuracy of the work, durability of the parts, and convenience of manipulation. This involves acquaintance with the processes and machinery of the workshops, but it is the foreman's and superintendent's knowledge which is required rather than the manual dex-

terity and skill of the workman and tool-hand. The acquirements peculiar to the latter are by no means despised and the students are encouraged to familiarize themselves therewith during leisure hours, but manual work in the shops forms no regular part of the course. On the contrary, the student enters the shop with hands and mind free to examine all processes, operations, and machinery, and is ready at the call of the teacher to witness any operation of special interest. Provided with note-book, pencil, calipers, and measuring rule, the student sketches the most important parts of the various machine-tools, notes down the successive steps of each of the important shop-processes as illustrated by the pieces operated upon, and follows the pieces of work through the shops from the pig or merchant form to the finished machine.

That the students may learn to observe carefully and be trained to think and observe for themselves in these matters, there is required of them a full description of the various processes, operations, and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings, and finished pieces, which are not being constructed in the shops at the time and the blue prints for which have been given to them on entering the shops. The student's work is directed not only by these drawings and by the printed program given him at the start, but also personally by a teacher, who accompanies him into the shops, gives necessary explanations, and tests the extent and accuracy of his knowledge by examining the sketches and notes and by frequent questioning. Finally the results of the observations and the sketches are embodied in a memoir.

During the course there are frequent visits of inspection to the Bethlehem Iron Company, the L. V. R. R. Shops at Easton, and other engineering works both in and out of town, with special reference to such subjects as machine elements, prime movers, machinery for lifting, handling and transporting, and machinery for changing the form and size of materials. It is intended that each of these

excursions shall have some definite purpose in view which must be fully reported by the students. These visits are also made the occasion for constant practice in the free-hand sketching of machinery.

The instruction in Machine Design begins with second term of the Freshman year and is continued throughout the course. At first tracings and blue prints of good examples of machine drawings are made. A thorough drill in projection drawing follows; in this work free-hand sketches are first made, and measurements taken, of machine pieces; these sketches are then converted into full-size working drawings. Then there is considerable practice in the interpretation of such drawings, and general views of lathes, planers, drills, and shapers are made from the drawings of the details. This is followed by difficult projections and intersections and exercises in the empirical proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice and the drawings made full size. During the Junior year the class takes up the design of a high-speed steam engine, every dimension being determined by the students and complete drawings made. During the Senior year the students undertake the calculations, estimates, and working drawings involved in the design of a simple but complete machine, each student being engaged upon a different machine. From the finished drawings of each machine tracings are made and then blue prints taken for distribution among the other members of the class. In the case of the machines and of the engine the general plan or arrangement will be given to the students in the form of rough sketches, photographs or woodcuts. In the last term the students are expected to make original designs for simple machinery, whose object has been fully explained. Throughout the course the work in the draughting-room is carried on as nearly as possible like that of an engineering establishment, and special attention

is paid to methods of expediting the work of calculation by means of simple formulas, tables, and diagrams.

All the students in this course are required to study German.

The graduates in this course will receive the degree of Mechanical Engineer (M.E.).

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

German.—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing and Machine Design.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (5)

English.—Rhetoric. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

Machine Design.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers, and connecting rods. (2)

Visits of Inspection.—Examination and sketching of principal machine parts in the shops of the vicinity. (2)

German.—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and Light. Lectures and recitations. (3)

German.—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Steam Engine.—Holmes' Steam Engine. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class optional throughout the year.

Mechanical Technology.—Shop instruction. Examination of the processes and appliances involved in pattern-making, moulding, forging, fitting, and finishing, with sketches and reports. (7)

Boilers.—Wilson. Strength, construction, and wear and tear of boilers. (1)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on experimental tests. (4)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

German.—Readings. Compositions. Lectures on German literature. (2)

Kinematics of Machinery.—Reuleaux. Nature and equivalence of mechanisms. (3)

Machine Design.—Calculations and working drawings for a high-speed steam engine. (5)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Machinery of Transmission.—Weisbach-Herrmann. (2)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Thermodynamics. — General principles; application to steam engines and air compressors. (3)

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Machine Design.—Calculations and working drawings for hoisting, pumping, and metal-working machinery. (4)

Kinematics.—Diagrams of the changes of position, speed and acceleration in mechanisms. Link and valve motions. Quick return motions. Parallel motions. Laying out of cams. (3)

Mechanics of Machinery.—Weisbach-Herrmann. Hoisting machinery, accumulators, cranes, and locomotives. Graphical statics of mechanisms. (4)

Gymnasium.

SECOND TERM.

Mechanics of Machinery.—Weisbach-Herrmann. Pumps, pumping engines, blowing engines, compressors, and fans. (4)

Machine Design.—Original designs. (5)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSES IN MINING ENGINEERING.

These courses aim to fit the student for practical work in either of the branches of mining, metallurgy, metallurgical chemistry, or geology. On account of the great number and scope of the studies necessary to the attainment of the degree of Engineer of Mines (E.M.), which includes that of Metallurgist, five years are required. At the end of the fourth year the student will have completed a course similar to that leading to the scientific degree in other institutions, and will receive the degree of Bachelor of Science (B.S.). On completing the first year, those who desire to practice mining alone are provided with a special course leading to the degree of Bachelor of Science (B.S.) in mining. The following program of subjects and studies shows the requirements for the degree of Engineer of Mines.

Modern Languages.—Although the option of studying French or German lies with the student, it may be well to note that the current literature of the subjects taught in these courses is more abundant in the latter language.

Drawing and Construction.—The course in machine design begins in the second term of Freshman year with tracings of good examples of machine drawings; then follow the interpretation of such drawings, and the making of general views of machines from detailed sketches; exercises in projection drawing from the same, and the proportioning of simple tools and machines. In Sophomore year

the student becomes acquainted with the arrangement and details of metallurgical plant and in Senior year he designs the same. The post-graduate, during the entire year, becomes acquainted with and designs mining plant. The field work in mining and geological surveying is followed by map construction from field notes. Practice in mining and metallurgical construction is also afforded by the projects.

CHEMISTRY. — The course in theoretical and applied chemistry extends over three years and includes work in wet and dry assaying of all the important ores and metallurgical products met with in actual practice, combined with the working of stoichiometric problems and the study of chemical philosophy. The practical work is that required for a metallurgical chemist or assayer.

With moderate care the expenses in this department need not exceed $120.

MINERALOGY.—This subject is divided into two courses. In the first course, after a short exposition of the laws of crystallography and a description of crystalline forms, practical exercises are held in the determination of simple and complex crystals, in which the student is taught to identify the various crystalline forms observed in minerals by the aid of models and of actual crystals, and with the use of the application goniometer. The second course includes the subjects of physical, descriptive, and determinative mineralogy. As in the first course, the greater part of the time is devoted to practical exercises, which, in this course, have for their object the determination of minerals. Each student is thus enabled to become familiar with the more common minerals by the actual handling of several hundred specimens, with the facility of making such tests as will not injure them. The presence of one or more instructors during each exercise permits the student to make frequent reports of his determinations, and to receive much instruction as to the characteristics of the minerals. The knowledge thus acquired can be supplemented by visits to the museum.

The course in blowpipe analysis may be considered as auxiliary to the practical exercises in determinative mineralogy. In the latter the student is urged to rely chiefly on physical tests; in the former he is required to determine minerals by the aid of the blowpipe.

The mineralogical laboratory offers facilities for an advanced course in crystallography and in physical and microscopic mineralogy to a few students who may receive permission to pursue such a course.

GEOLOGY.—This subject is studied with special reference to the needs of the mining engineer. Within a radius of twenty miles the student meets and becomes acquainted with the rocks of the archæan, the palæozoic, and the mesozoic formations, and makes geological maps from his own field notes, paying attention to the lithological characters of the formations, as they are mainly non-fossiliferous south of the Blue Ridge. An extended practical course in lithology familiarizes the student with the rocks of importance to the mining engineer and enables him to determine them by sight. There are over 2000 specimens in the collection, embracing all the known species. The course in historic geology is illustrated by a cabinet of typical specimens. The course in economic geology supplements the above work by familiarizing the student with the geological horizon of all the valuable constituents of the earth's crust and the theories of their formation. As Bethlehem is near the center of the "extra-moraine" drift, exceptional facilities are afforded for the study of pleistocene geology in Eastern Pennsylvania.

ASTRONOMY.—After studying the theory of the subject two-thirds of the year are devoted to practical work in the observatory.

APPLIED MECHANICS.—This embraces hydraulics, a study of the steam engine, and the mechanics of machines employed in mining and metallurgy.

SURVEYING.—A course extending over three terms offers practice in land, mine, and geological surveying, leveling, topography, triangulation, railroad reconnaissance and location, and the use of the solar transit. It also includes practical work in drawing and map construction.

METALLURGY.—There are two courses of, together, about one hundred and forty lectures upon this subject, which extend throughout a year. In these the chief object kept in view is a clear presentation of the principles involved in the various metallurgical processes, looked upon as the application to practice of the laws of chemistry, physics, and mechanics. This is followed, in the case of each process, by a description of the more important examples of the plant and of the methods of conducting the process, and by indications concerning its economic features. In order to ensure that the student shall understand the fundamental principles of metallurgy, and shall become so familiar with them as to be able readily to apply them, he is required to solve a series of problems in which these principles are involved. Many of the problems are such as are likely to present themselves to the metallurgist in his current practice.

The metallurgical laboratory affords opportunity for special investigations in subjects connected with metallurgy to such advanced students as are competent to conduct them.

MINING.—This subject is covered by three courses. The first begins with the application of economic geology to the needs of the engineer, so that he can study and value mining properties, locate appropriately the necessary plant, and calculate the cost of production. It includes the discussion of faults and the means of finding faulted bodies, with practical problems. The subjects of blasting, timbering, and winning deposits are applied to actual cases, as tunnel-driving, etc., and problems from practical data are solved by the students. The second course covers the subjects of underground and surface haulage; loading, un-

loading, and stocking ores; pumping; ventilation; hygiene and mining law. A series of problems is given in each of these subjects to cover cases that meet the engineer in ordinary practice. The third course treats of the mechanical preparation of ores by the wet, dry, or magnetic methods, and especially of the preparation of anthracite coal.

The location of the University in the vicinity of the iron works of the Lehigh Valley, and especially of the extensive establishment of the Bethlehem Iron Company, affords unusual facilities for the practical study of iron metallurgy. The processes for the manufacture of spelter and oxide of zinc may be studied at the Bethlehem Zinc Works. The facilities for the practical study of mining and economic geology are not excelled by those of any other institution in the country. The zinc mines at Friedensville, the paint ores of the Marcellus formation, and the brown hematite and slate deposits of the Lehigh Valley are in the immediate vicinity, while within easy reach by rail are the semi-bituminous and anthracite coal fields, the block and fossil iron ores of the Clinton measures, the iron mines at Cornwall, Pennsylvania, and the iron and zinc mines of New Jersey; together affording examples of nearly all the methods of winning and dressing valuable deposits. Numerous visits of inspection are made in connection with the work of the course, to familiarize the student with metallurgical and mining processes and afford data for practical examples and projects.

THE COURSE IN MINING ENGINEERING.

This course is arranged so that the subjects which prepare the student for practice in the field of metallurgy shall be completed at the end of four years, when the graduate will receive the degree of Bachelor of Science in Metallurgy (B.S.). By remaining a year longer, and taking the subjects laid down for the post-graduate year, the graduate in the course may obtain the degree of Engineer of Mines (E.M.).

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

French.—Grammar and reader (continued). (3) *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches. General views from given details. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., illustrated from examples of mining and metallurgical plant. Graphical problems illustrating the direction and extent of throw in faults. (5)

English.—Rhetoric. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—General views of metallurgical plant and detailed sketches. (2)

Surveying.—Theory and use of the level, compass, and transit. Surveys and maps of farms.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

Stoichiometry. (2)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Chemical Philosophy.—Tilden. Chemical calculations. Whiteley. (3)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2)

Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Fresenius' Quantitative Analysis. (4) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Copper ore (Cu).
3. Silver coin (Au, Ag, Pb, Cu).
4. Zinc ore (Zn). By both gravimetric and volumetric methods.
5. Bronze (Cu, Sn, Zn, Pb).
6. Spiegeleisen (Mn).
7. Lead ore (PbS).
8. Ilmenite (TiO_2).
9. Iron ore (complete analysis).
10. Limestone (complete analysis).
11. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).

Steam Engine.—Holmes' Steam Engine. (3)

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Literature and History.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, etc. (5)

Blow-Pipe Analysis.—Practice. (1)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Mechanics of Machinery.—Herrmann-Smith. The graphical statics of mechanisms. (2)

Chemistry. — Quantitative analysis: laboratory work: Fresenius. (3) The following analyses are executed by the student:

12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).
15. Nickel ore (Ni, Co).
16. Gas analysis.

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Gymnasium.

SECOND TERM.

Mining.—Prospecting. Economic geology. Boring. Valuation of property. Methods of mining. Lectures. Williams. (3) Mechanical preparation of ores. Coal washing. Lectures. (2)

Drawing.—Designing of furnaces and other metallurgical plant. (2)

Mechanics of Machinery. — Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

POST-GRADUATE YEAR.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (4)

Geology.—General geological definitions and principles. Dynamic geology. Le Conte. (2)

Drawing.—General views of mining plant and detailed sketches. (2)

Surveying.—Mine survey. Theory and practice, with construction of mine maps. Tunneling and shaft location. (2)

Astronomy.—Young's General Astronomy. (3)

Surveying.—Triangulation. Leveling. Topographical surveys with transit and stadia. Topographical maps. (4)

SECOND TERM.

Mining.—Timbering and walling. Support of excavations. Tunneling. Lectures. (2)

Geology.—Historic geology. Le Conte. (2)

Projects.—In geology and mining.

Surveying.—Geological survey: mapping and cross-sectioning. (2)

Drawing.—Designing of mining plant. (2)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map and estimate of cost. Lectures on construction and maintenance. (4)

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Preparation of Thesis.

THE SHORTER COURSE IN MINING.

This course is designed so that the student who desires to pursue the practice of mining and ore-dressing, and who does not wish to take the full course, may be prepared for practice in four years, receiving the degree of Bachelor of Science in Mining (B.S.).

This course is identical with the preceding up to the end of the Freshman year.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Mining Technology.—Kinds and systems of timbering. Details of haulage and hoisting plant. Freehand, isometric, and detailed drawings. (5)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. (2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Geology.—General geological definitions and principles. Dynamic geology. Le Conte. (2)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Surveying.—Triangulation. Leveling. Topographical surveys with transit and stadia. Use of plane table. Topographical map. (4)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Geology.—Historic geology. Lectures. LeConte. Dana. (2)

Mining.—Prospecting. Economic geology. Boring. Valuation of property. System of mining. Lectures. Williams. (3)

Steam Engine.—Holmes' Steam Engine. (3)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. Lectures on construction and maintenance. (4)

Drawing.—General views of mining plant and detailed sketches. (2)

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Literature and History.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (4)

Graphical Statics.—Graphical analysis of roof-trusses and girders. (2)

Astronomy.—Young's General Astronomy. (3)

Surveying.—Mine survey. Theory and practice, with construction of mine maps. (2)

Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (3)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Gymnasium.

SECOND TERM.

Mining.—Timbering and walling. Support of excavations. Tunneling. Lectures. (2) Mechanical preparation of ores. Coal washing. (2)

Projects.—In mining. Designing of mining plant. (3)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Surveying.—Geological survey: mapping and cross-sectioning. (2)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

POST-GRADUATE YEAR.

Students who have completed the last course may obtain the degree of Engineer of Mines (E.M.) by one year's post-graduate work, though it is desired that all who intend taking that degree shall pursue the regular course, first given.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, etc. (5)

Blow-Pipe Analysis.—Practice. (1)

Chemistry.—Quantitative analysis: laboratory work: Fresenius. (3) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Copper ore (Cu).
3. Silver coin (Au, Ag, Pb, Cu).
4. Zinc ore (Zn). By both volumetric and gravimetric methods.
5. Bronze (Cu, Sn, Zn, Pb).
6. Spiegeleisen (Mn).
7. Lead ore (PbS).

Mechanics of Machinery.—Herrmann-Smith. The graphical statics of mechanisms. (2)

Chemical Philosophy.—Tilden. Chemical calculations. Whiteley. (3)

Drawing.—General views of metallurgical plant and detailed sketches. (2)

SECOND TERM.

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Chemistry.—Fresenius' Quantitative Analysis. (4) The following analyses are executed by the student:

8. Ilmenite (TiO_2).
9. Iron ore (complete analysis).
10. Limestone (complete analysis).
11. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).
12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).
15. Nickel ore (Ni, Co).
16. Gas analysis.

Drawing.—Designing of furnaces and other metallurgical plant. (2)

Mechanics of Machinery.—Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Preparation of Thesis.

THE COURSE IN PHYSICS AND ELECTRICAL ENGINEERING.

In the arrangement of the details of this new course the object has been to provide for those who seek to fit themselves as Electrical Engineers a preliminary training as complete and broad as that given to the members of the other schools. The requirements for admission, the mathematical and English studies, the modern languages and other outside branches are the same as those in the other technical courses. To these have been added such portions of the Mechanical Engineering Course, with which this course is most closely allied, as are necessary to give the student a general but sufficiently accurate knowledge of machinery.

This preparation joined to the unusually full development of Physics—and especially of Electricity—will, it is thought, make a course sufficiently comprehensive and thorough for the proper training of candidates for this

degree. The great success attending the large majority o the young men who have taken the one year's course i Electricity, in their subsequent electrical work, warrant the belief that this broader and more extended course wil attain its object.

The main feature of this new course is the prominenc given to the subject of Physics. This extends througl three years, and while Electricity is specially developed th other branches, Elementary Mechanics, Heat and Light are fully provided for. The opportunity is thus given t any one who wishes to acquire a more extensive knowledg of Physics than the University curriculum has heretofor offered. The student is well drilled in the theory by mean of lectures and recitations, which carefully cover the whol subject, and he is required to go over the ground himself i the best of all schools—the working laboratory. Enoug of work on each topic is given him to render him familia with his subject. Much prominence is given to work tha brings out the resources of the student himself, such as th construction of instruments and original investigation. H is encouraged to this and a regular portion of his time is se apart for this object.

It will be seen from the preceding statement that thi course offers two great advantages: the thorough an extensive training of those intending to take part in th great development of Electric Science in the industria field now going on and the facilities offered to those wh wish to take a four years' course specially devoted to th whole branch of Physics.

The practical work of the Physical Laboratory is to extensive to allow of full details being given in the follow ing arrangement of the course. The more importan subjects developed may be mentioned here. In Mechanics exact measurements, specific gravity, barometric leveling In Heat, calorimetry and hygrometry. In Light, testing o optical instruments, spectroscopic analysis and photometry In Magnetism, study of laws of force, determination o moments of magnets and of horizontal components of in

tensity of earth's magnetism in absolute units. In Meteorology, observations for several months as taken in the U. S. Signal Service stations, with all the usual corrections and reductions; construction of charts; mapping curves; reports, etc. In Electricity, management of batteries, construction of instruments, electrical measurements, electrolysis and relation of electrical currents to heat and mechanical work; practical running and care and tests of dynamos for efficiency, etc.; electric lighting, with photometric tests of arc and incandescent lamps; measurement of heat units given off by lamps, their resistance (hot and cold); energy consumed in lamps; spectroscopic tests of purity of carbons; study of telegraph and telephone and of the application of electricity to railways; visits to manufactories, working systems, electric railways, etc.

In Magnetism, during the last year, attention has been given, both in lectures and in the laboratory work, to the investigation of the magnetic properties of iron, magnetic moment, intensity of magnetization, magnetic induction, permeability, susceptibility, hysteresis, etc. Both the inductive and magnetometer methods are used. The study the magnetic circuit and the designing and calculation of a dynamo form part of the regular work of each student.

A deposit of $25 is required from each student before he is allowed to work in the laboratory. From this, at the end of the term, is retained the cost of any material wasted or apparatus injured by him during the term.

The degree of Electrical Engineer (E. E.) will be given to the graduates of this course.

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (2)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Descriptive geometry and isometric drawing. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat; text-book, Stewart. Magnetism and electricity; text-book, S. P. Thompson's Electricity and Magnetism. (3)

Mechanics, Sound and Heat.—(Physical laboratory.) (4)

Machine Design.—(2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Heat (continued), Magnetism, and Light.—(Physical Laboratory). (2)

Physics.—Magnetism; text-book, S. P. Thompson. Sound and Light; text-book, Stewart. (1)

Chemistry.—Lectures on Photography.

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl:

Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Steam Engine.—Holmes' Steam Engine. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation, Compositions. (2) Or *German.*—Lessing, Herder, Goethe. Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Electricity and Magnetism.—Lectures with recitations; text-book, Slingo and Brooker's Electrical Engineering. (3)

Electricity; Electrical Measurements.—(Physical laboratory.) (3)

Meteorology.—Text-book and practice. (1)

Strength of Materials.—Elasticity and strength of wood, stone and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Boilers.—Wilson. Strength, construction and wear and tear of boilers. (1)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Dynamo Design.—Text-book, S. P. Thompson's Dynamo-electric Machinery, with lectures.

Magnetic Properties of Iron.—Text-book, Ewing's Magnetic Induction in Iron. (3)

Electrical Measurements; Magnetic Properties of Iron. Physical Laboratory. (5)

French.—Readings. Compositions. Lectures on French Literature. (2) Or *German.*—Readings. Compositions. Lectures on German Literature. (2)

Surveying.—Theory and use of instruments. Location and construction of electric railways. (2)

Alternating Currents.—Recitations with text-book. (3)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Dynamo Design (continued). (3)

Dynamic Machines and Electric Lighting.—Practice in running and care of. Tests of efficiency in generators and motors, photometric and spectroscopic tests of lamps, etc. (Physical laboratory.) (5)

Applications of Electricity.—Telegraphs and telephones. (3)

Astronomy.—Young's General Astronomy. (3)

Mechanics of Machinery.—Herrman-Smith. The graphical statics of mechanisms. (2)

Gymnasium.

SECOND TERM.

Electric Railways.—Text-book, Crosby and Bell. Plans for an electric railway, with maps, specifications, etc. (4)

Hydraulics. (2)

Measurement of Power.—Indicating of steam engines and dynamometer experiments. (1)

Lectures on English and American Literature. (2)

Christian Evidences. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN CHEMISTRY.

This course of study is designed to prepare students for the profession of the chemist, in connection with metallurgical establishments, sugar refineries, gas works, superphosphate works, electrical machinery manufactories, mining companies, etc., and the general consulting and analytical work of the professional chemist. It is also well adapted for the preparation of teachers of chemistry and as a preliminary course to the study of medicine. It is eminently practical, the student's time being largely occupied by practical work in the large, well equipped and well ventilated chemical laboratories, which were completed in 1885 and constitute the best constructed building for this purpose in this country. The museum of chemistry contains large collections of specimens, for illustrating the lectures on theoretical and applied chemistry.

THEORETICAL CHEMISTRY.—Instruction in this subject begins with lectures four times a week, in the first term of the Freshman year. These lectures are fully illustrated by experiments, colored diagrams, working drawings and lantern pictures, and specimens from the museum. They include a general introduction to theoretical chemistry, and a description of the non-metallic and metallic elements and their compounds, the general subject of inorganic chemistry. The students are required to take notes of the lectures, and to pass a written examination at the end of the term.

In the second term of this year stoichiometry and chemical problems and reactions are taught by recitations twice each week.

The study of theoretical chemistry is continued throughout the Sophomore year by recitations three times a week from Tilden's Chemical Philosophy and Remsen's Chemistry, in the first term of the Junior year, by a course of lectures and recitations on theoretical organic chemistry, four times a week and twice a week in the second term.

These lectures are illustrated by experiments and by specimens from the museum of chemistry.

Written examinations are held at the close of each of the above courses.

ANALYTICAL CHEMISTRY.—Qualitative analysis is taught in the second term of the Freshman year, by lectures, recitations, and practical work in the qualitative laboratory, twelve hours of practical work per week being required. This laboratory is a large, well ventilated, and well lighted room, supplied with convenient working tables, vacuum filtration, hoods for noxious vapors, steam baths, gas and washing appliances, and a commodious room for hydrosulphuric acid. Distilled water is delivered by faucet in this room and the other large laboratories. At the close of the term a practical examination is held in this subject.

After completing this course, quantitative analysis is pursued throughout the Sophomore and the first term of the Junior years. This subject is taught by lectures, recitations, and practical work in the quantitative laboratory, which is equipped similarly to the qualitative laboratory, but is supplied in addition with apparatus for drying precipitates and residues, rooms for the chemical balances, for combustions, and for a reference library.

Twelve hours per week are required during the first term of the Sophomore year and fifteen hours during the second term of that year and the first term of the Junior year.

The course consists in gravimetric and volumetric analyses, as applied to the substances given in the lists farther on, accuracy being required in the determination of each constituent.

At the close of each term written examinations are held upon the theory and practice of quantitative analysis.

GAS ANALYSIS is taught by lectures and laboratory practice in the gas laboratory. This laboratory is supplied with full and complete apparatus for gas analysis, according to Bunsen's processes, as well as apparatus for some of

the more rapid methods. Mixtures of gases are required to be analyzed by the students, within certain limits of error, and a written examination, on the theory and practice, is held at the close of the course.

ASSAYING.—The assaying of ores by furnace assay, together with gold and silver bullion analysis, by processes practiced in the United States Mint, is taught by lectures and practical work in the first term of the Senior year, nine hours of practical work per week being required. The course includes the assaying of ores of lead, tin, antimony, gold, silver, and iron, coal, and gold and silver bullion.

The assaying laboratory is supplied with large working tables, twenty-nine crucible and two iron furnaces, and eight muffle furnaces, with adjoining rooms for balances, and gold and silver bullion analysis.

A certain accuracy of results and a written examination as regards theory and practice are required.

ORGANIC CHEMISTRY.—The practical work in this subject is performed in the second term of the Junior year, fifteen hours per week being required, with conferences and recitations each week. The laboratory for this work is equipped similarly to the quantitative laboratory, in addition being supplied with steam, cold water and air blast upon the working tables, and a full supply of apparatus for the various determinations and experiments, including combustion furnaces, furnaces for heating sealed tubes, mercury pump, Hoffman's, Dumas' and Meyers' apparatus for vapor densities, nitrometers, chemical balances, etc.

The course consists of determinations of specific gravities, melting points, boiling points, vapor densities, chlorine, bromine, iodine, and sulphur of organic substances.

Combustion analysis, nitrogen determination, fractional distillation, and the preparation of several pure organic compounds and their analysis are included.

INDUSTRIAL CHEMISTRY.—A course of lectures is delivered upon this subject in the second term of the Senior

year, illustrated by experiments, diagrams, lantern pictures, and specimens from the museum of chemistry. The working laboratories for this subject contain an apparatus for making illuminating gas, an alcohol still, worm and doubler, and a complete working model of a sugar refinery, including filters, vacuum pan, and centrifugal. There is also apparatus for use in the manufacture of chemicals, for dyeing, calico printing, and bleaching. In connection with these laboratories is a room containing a photometer and apparatus for determining the sulphur, ammonia, and specific gravity of illuminating gas; also a laboratory for the testing of alcoholic liquors, sugar, molasses, bone black, soap, petroleum, paints, dyes, superphosphates, and other commercial products, with the necessary technical apparatus. The students make practical experiments in this direction, and, with an instructor, visit various industrial establishments in this neighborhood and in and around New York City.

Toxicology.—A course of lectures on this subject is given in the first term of the Junior year, illustrated by experiments and by the large collection of specimens of poisons from the museum of chemistry. This is supplemented by a short course of laboratory work on some of the common poisons.

Sanitary Chemistry.—During the second term of the Senior year attention is given to the qualitative and quantitative examination of air, water, food, disinfectants, and other subjects connected with this branch of the science. Special apparatus is provided for this work, as recommended by the best authorities on the subject.

Photographic Chemistry.—A well equipped photographic laboratory and dark rooms are provided, in which the students of the chemical course receive practical instruction.

Physiological Chemistry.—The examination of urine, blood, etc., receives a proper amount of attention.

The course also includes instruction in physics, mineralogy, blowpipe analysis, metallurgy, and geology, which are of great value to the chemist.

MICROSCOPY.—Instruction in the use of the microscope is given in the first term of the Senior year.

In the Senior year the student is required to prepare a thesis on some subject, selected by the Professor of Chemistry, involving practical work in the laboratory in addition to the literary labor, each graduate thus making a contribution to the progress of the science, as a preliminary to the reception of his degree.

The graduate of this course receives the degree of Analytical Chemist (A.C.).

Students, not candidates for a degree, are admitted for special courses in chemistry, of which they will receive certificates.

The laboratories are under the immediate charge of the Professor and Instructors of Chemistry and are open to the students from 8 o'clock A.M. to 6 o'clock P.M., including Saturdays. Students are at liberty to work in the laboratories beyond the required hours as their time may permit. Students are charged for materials and apparatus consumed; with moderate care this expense need not exceed $50 per year.

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

German.—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Stoichiometry. (2)

English.—Rhetoric. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Chemical Philosophy. — Tilden. Chemical calculations. Whiteley. (3)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (4)

The following analyses are executed by the student:

1. Iron wire (Fe).
2. Potassium dichromate (Cr_2O_3).
3. Barium chloride (Ba, Cl, H_2O).
4. Magnesium sulphate (MgO, SO_3, H_2O).
5. Disodium hydrogen phosphate (P_2O_5).
6. Rochelle salt (K_2O, Na_2O).
7. Volumetric determination of chlorine.
8. Acidimetry (HCl, H_2SO_4, HNO_3, $HC_2H_3O_2$).
9. Alkalimetry (KOH, NaOH, NH_4OH, soda ash, pearl ash).
10. Chlorimetry (bleaching powders).

Quantitative Analysis.—Conference. (1)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

German.—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Physics.—Sound and light. Lectures and recitations. (3)

German.—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

11. Copper ore (Cu).
12. Zinc ore (Zn). By both gravimetric and volumetric Methods.
13. Lead ore (Pb, S).
14. Silver coin (Au, Pb, Ag, Cu).
15. Spiegeleisen (Mn).
16. Copper alloys (complete analysis).
17. Ilmenite (TiO_2).
18. Iron ore (complete analysis).
19. Limestone (complete analysis).
20. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).
21. Slag (complete analysis).

Quantitative Analysis.—Conference. (1)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Remsen. Advanced course. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Toxicology.—Lectures. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

22. Guano (NH_3, P_2O_5, H_2O).
23. Clay (complete analysis).
24. Manganese ore (MnO_2).
25. Mineral water (complete analysis).
26. Pig iron (complete analysis).
27. Nickel ore (Ni, Co).
28. Carbon in steel (volumetric).
29. Gas analysis.

Quantitative Analysis.—Conference. (1)

Organic Chemistry.—Lectures and recitations. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Organic Chemistry.—Laboratory. (5)

Organic Chemistry.—Lectures and conferences. (2)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

German.—Readings. Compositions. Lectures on German literature. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. E. S. Dana. (3)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, etc. (5)

Assaying.—Including the assay by the dry method of gold, silver, antimony, lead, iron, and tin ores, coal, gold and silver bullion, and rich lead. Ricketts. (3)

Industrial Chemistry.—Laboratory. (3)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Microscopy.—Laboratory. (2).

Preparation of Thesis.

Gymnasium.

SECOND TERM.

Industrial Chemistry.—Lectures. (3)
Industrial Chemistry.—Laboratory. (3)
Industrial Chemistry.—Conference. (1)
Agricultural Chemistry.—Laboratory. (1)
Sanitary Chemistry.—Laboratory. (1)
Geology.—Historic and dynamic geology. Lectures. Geikie. (2)
Christian Evidences.—Lectures. (1)
Lectures on American and English Literature. (2)
Preparation of Thesis. (2)
Gymnasium.

THE COURSE IN ARCHITECTURE.

The studies in this course are closely allied with those in civil engineering, the higher surveying, railroad work, mineralogy, geology, and astronomy being omitted, instead of which architectural drawing and designing is substituted as seen in the following program. Instruction is also given in the history and æsthetics of architecture, in methods of heating and ventilating, in boilers and hoisting machinery, and in house drainage and sewerage.

During the first and second years the student lays the foundation for his professional work by the study of mathematics, physics, mechanics, drawing, surveying, English, and French or German. The course in drawing includes the use of water colors, free-hand, projection and isometric drawing, and their application to the general plans for a small building. In surveying there is field practice in the use of instruments, and also map drawing, thus enabling the student to understand the application of the subject to landscape gardening, and to the location of buildings.

During the third and fourth years of the course the work is of a more professional character. The subject of construction familiarizes the student with brick, stone, cement, and other materials, with foundations and masonry, with

arches, piers, and walls, and with the stone-cutter's art. There is a full course in the theory and calculation of columns, beams, and shafts, in the strength of materials and its application to roof trusses and bridges. Working drawings of arches, piers, and roof trusses are made in detail. Plans and estimates are prepared for wooden, brick, stone, and iron buildings, the work being done according to standard specifications. In connection with the course visits of inspection are made to the numerous engineering structures in the Lehigh Valley and vicinity.

The student who completes all the subjects of this course will receive the degree of Bachelor of Science in Architecture (B. S.).

FRESHMAN CLASS.

FIRST TERM.

See Page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Construction.—Materials. Masonry. Carpentry. Roads and pavements. Sketches and structures. (2)

French.—Grammar and Reader (continued). (3) Or *German.*—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Descriptive geometry and isometric drawing. Tracings. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—Architectural drawing. Plans of piers and arches. Problems in stone cutting. (4)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and light. Lectures and recitations. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus, and Wood's Analytical Mechanics. (2)

French.—Corneille,. Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Strength of Materials. — Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Construction.—Foundations. Specifications and estimates. Reports on structures. Tests of cements. (2)

Drawing. — Shades, shadows, and linear perspective. Sketches and designs for ornaments and simple details. (6)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.* — Readings. Compositions. Lectures on German literature. (2)

Roofs and Bridges. — Theory and calculation of strains in roof and bridge trusses. Graphical statics. (5)

Construction.—Retaining walls, masonry dams, and stone arches. Plans and estimates. (2)

Architecture.—Designs and estimates for brick and stone buildings. (4)

History.—The history and styles of architecture. (2) Lectures on Roman antiquities. (1)

Literature and History. (1)

Gymnasium. (2)

SENIOR YEAR.

FIRST TERM.

Roofs and Bridges. — Cantilever, suspension, and arch bridges. Designs for plate girders and riveted roof trusses. (6)

Mechanics of Machinery.—Pile drivers, cranes, and elevators. (2)

Boilers.—Strength, construction, and wear and tear of boilers. Wilson. (1)

Architecture. — Specifications and estimates. Design for an iron building. (5)

Heating and Ventilation.—Systems of heating, lighting, and ventilating buildings. (2)

Gymnasium.

SECOND TERM.

Hydraulics.—Efflux of water from orifices, and flow in pipes and channels. Hydraulic motors. Practical work in the hydraulic laboratory. (2)

Sanitary and Irrigation Engineering.—Collection, purification, and distribution of water. Systems of water supply. The combined and the separate system of sewerage. Drainage and sewerage of buildings. (4)

Roofs and Bridges.—Design for a pin-connected roof truss, with working drawings and estimates. (3)

Architecture.—Building superintendence. The æsthetics of architecture. Original plans, estimates, and specifications. (4)

Lectures on English and American Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

PHYSICAL CULTURE.

The Gymnasium is open morning, afternoon and evening, in all, 45 hours a week. Exercise in it is required of all students who are fitted to take it. Class drill with the Instructor and individual exercise are prescribed.

GRADUATING THESES.

Every student will be required to present a thesis upon some topic connected with his special course, as a necessary portion of the exercises for his final examination for a diploma. These theses shall be accompanied by drawings and diagrams, when the subjects need such illustration. The originals will be kept by the University, as a part of

the student's record, for future reference; but a copy may be retained by the student, and be published, permission being first obtained from the President.

DIPLOMAS AND CERTIFICATES.

The Diploma is given only to those who have passed all the examinations in a regular course and is signed by the Secretary of the Board of Trustees and by the Faculty of the University. For all the partial courses a certificate is given, signed by the Secretary of the Faculty, and showing what the student has accomplished.

GRADUATE STUDENTS.

Graduate students wishing to remain a year or more and pursue a course of study as candidates for another Degree may do so with the sanction of the Faculty. Those wishing to take *special* courses of study will be afforded every facility for so doing.

POST-GRADUATE DEGREE.

M. A.

The Faculty will recommend for the Degree of Master of Arts any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Arts, shall pursue, for at least one year at this University, or two years elsewhere, a course of liberal study prescribed by the Faculty in at least two departments, (under at least two professors), pass a thorough examination in the same and present a satisfactory Thesis.

M. S.

The Faculty will recommend for the Degree of Master of Science any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Science, or any Degree in the School of Technology, shall pursue, for at least one year at this University, or two years elsewhere, a course of study prescribed by the Faculty

in at least two departments, (under at least two professors), pass a thorough examination in the same and present a satisfactory Thesis.

Ph. D.

The Faculty will recommend for the Degree of Doctor of Philosophy any candidate, otherwise properly qualified, who, after taking at this University the Degree of Master of Arts or Master of Science, shall pursue, for at least one year at this University, a course of advanced study prescribed by the Faculty, in at least two departments, (under at least two professors), pass a thorough examination in the presence of the Faculty in the same and present a satisfactory Thesis giving evidence of original investigation.

The candidate shall have a good knowledge of Latin and either French or German.

The Theses presented by candidates for Post-Graduate Degrees shall be retained by the University.

Applicants for any of these degrees will be required to complete the prescribed work within the allotted time. Special action of the Faculty is required for any extension of time.

THE UNIVERSITY LIBRARY.

The Library building was erected by the Founder of the University in 1877, at a cost of $100,000, as a memorial of his daughter, Mrs. Lucy Packer Linderman, and during the same year more than $20,000 were contributed by her family and friends as a memorial fund for the purchase of books. By the will of the Founder of the University a fund of $500,000 has been given for the permanent endowment of the library.

The building is semi-circular in plan, with a handsome façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior, the center is occupied as a reading space, fifty by forty feet, from which radiate the book cases, extending from floor to ceiling; two galleries affording access

to the upper cases. Shelf room is now provided for one hundred and sixty thousand volumes. The building is thoroughly fireproof, well lighted, and heated by steam.

Ninety-three thousand volumes are now upon the shelves, including many extremely valuable works. The list of periodicals numbers about two hundred and fifty, embracing as far as possible all departments of knowledge.

The Library is conducted strictly for consultation, and is open to the use of the public; both of which conditions are in accord with the terms of the gift.

REGULATIONS OF THE LEHIGH UNIVERSITY LIBRARY.

I. The Library is open every day, except Sundays and Legal Holidays, from 8 A.M. until 10 P.M., and on Sundays for the students and others connected with the University from 1.30 P.M. until 9.30 P.M.

II. Admission is free to all persons over 16 years of age.

III. Readers are required to write their names and addresses in the Daily Register of the Library. They also write the name of the book desired upon a Library Card, with their signatures, and present the same to the Director's Clerk, who supplies the book, retaining the card as a receipt. Before leaving the Library, readers return their books to the clerk, and receive their cards.

IV. The University Professors and Instructors, only, are allowed to take books from the Library Building.

V. No person is allowed to enter the alcoves, or remove any book from the shelves, without permission of the Director.

VI. Readers wishing to consult the more valuable illustrated works make special application for that purpose.

VII. In taking notes, pencils, and not pens and ink, are to be used.

VIII. Audible conversation and the use of tobacco are strictly forbidden in any part of the Library.

IX. Any person not conforming to these Regulations will be denied the privilege of the Library.

X. Any person who defaces, in any way, any book, magazine or paper, or the furniture, or any portion of the building, in addition to being deprived of the privileges of the Library will be prosecuted according to law.

OBSERVATORY.

By the liberality of Robert H. Sayre, Esq., one of the Trustees of the University, an astronomical observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

In the dome of the observatory is mounted an equatorial telescope, of six inches aperture, by Alvin Clark & Sons. The west wing contains a superior sidereal clock, by Wm. Bond & Sons; a zenith telescope, by Blunt, and a field transit, by Stackpole. There is also a prismatic sextant, by Pistor & Martins.

Students in practical astronomy receive instruction in the use of the instruments and in actual observation.

The grounds upon which the Observatory stands, consisting of seven acres of land adjoining the original grant, were presented to the University by Charles Brodhead, Esq., of Bethlehem.

THE UNIVERSITY MUSEUM.

In addition to the large collection illustrating all branches of Industrial Chemistry, the Museum includes collections in Metallurgy, Geology, Zoölogy, and Archæology.

The Metallurgical Cabinet already includes specimens illustrating the various processes for obtaining the more common metals.

The Zoölogical Cabinet includes the Werner collection of nearly all the types of American birds with their nests and eggs, and the Packer collection of recent shells.

The Geological Cabinet numbers over ten thousand specimens and includes the Palæontological, Mineralogical,

Petrographic, and Economic collections. The first contains good specimens of nearly all the common genera. The Mineralogical division includes the Keim and Rœpper collections—the latter being especially complete and valuable from a crystallographic standpoint. The Petrographic division numbers several thousand specimens and, besides including numerous varieties of nearly all the rocks of the globe, contains a duplicate set from the collection of the Second Geological Survey of this State. The Economic division was formed and donated by Dr. James P. Kimball, ex-Director of the Mint, and formerly Professor of Economic Geology.

The Cummings Archæological Cabinet numbers three thousand specimens and includes Dr. Stubbs' collection of Indian relics, weapons, and utensils.

SUMMER SCHOOL OF SURVEYING.

A Summer School of Surveying, extending over a period of five or six weeks, is held during the long vacation, provided that the attendance of at least twelve students is assured. In 1894 the school will open on August 1 at Hazleton, Pa., or at some other place in the anthracite coal region. Applications to join it should be made to the President before June 1, 1894.

Students of the University who have completed the surveying work of the Sophomore year, and other persons who present satisfactory evidence of having a good knowledge of algebra, trigonometry, and land surveying, and of having had some practice with the transit and level, may be admitted to the Summer school. The tuition fee is $25, payable in advance.

The work of the Summer school is under the direction of the Professor of Civil Engineering. Instruction is given by lectures or text-books in the theory of instruments, their care and adjustments, in the best processes for topographical work, in geodesy, and in the method of least squares. The field work includes base line measurements,

topography by stadia, plane table, and other methods, leveling, sketching, and all the operations of a complete topographical survey. The office work comprises the computations necessary for the reduction of the field notes, including the adjustment of the triangulation, practice in topographical drawing, and the preparation of a finished map of the territory covered by the survey. One day in each week will be devoted to visits of inspection to mines, quarries, bridges, and engineering works in Eastern Pennsylvania.

At the close of the session of the Summer school, examinations are held covering its entire course of theory and practice. Students of the University holding certificates of having completed the work of the school are not required to take the regular courses in surveying given in the Civil Engineering department during the first term of the Junior year, and the first term of the Senior year.

THE CHEMICAL AND NATURAL HISTORY SOCIETY OF THE LEHIGH UNIVERSITY.

This Society was organized in the Fall of 1871, as "The Chemical Society," but was afterwards expanded, as its present title indicates, and admits, by election, students from all departments of the University.

The collections of botanical and zoölogical specimens belonging to the Society are already important. During the past years persons have been sent to Texas and Brazil to collect specimens for these cabinets.

The Society has organized and maintained several courses of public scientific lectures.

Among the honorary members of the Society are more than one hundred of the most distinguished scientists in Europe and the United States.

THE ENGINEERING SOCIETY.

This Society was organized in 1873, and admits, by election, students in the Junior and Senior Classes. Its meetings are held fortnightly. At these, papers relating to engineering subjects are read and discussed. From 1885 to 1890 it issued quarterly five volumes of "The Journal of the Engineering Society," containing contributions by the members, alumni, and others. Many of the papers read before this society since 1890 have been published in "The Lehigh Quarterly," a journal published by the students of the University.

THE MINING CLUB.

This was organized in 1883 and takes from the Junior, Senior, and Post-Senior Classes those members of the Mining School who excel in their studies or in practical experience in the subjects of the course.

THE ELECTRICAL ENGINEERING SOCIETY

was organized in November, 1887, by students in the Advanced Course in Electricity. Its object is to supplement the regular work of the department by the study and discussion of electrical subjects.

THE AGORA

is a literary society which meets semi-monthly. Only students in the School of General Literature are eligible to membership.

THE ATHENÆUM

is also a literary society, whose active membership is confined to the Sophomore Class. The meetings are held weekly.

THE CLASSICAL CLUB.

This organization was founded in the Spring of 1889, and consists of the students in the Classical and Latin-

Scientific Courses, together with those members of the Faculty who are interested in this department of learning. At its monthly meetings, papers upon philological, historical, and archæological subjects are read by students belonging to the upper classes, and are then discussed and criticised. Thus independent work is encouraged and correct methods of investigation are acquired. This is especially valuable for those men who purpose becoming teachers or original investigators. Reports upon new discoveries and reviews of recent books vary the proceedings and keep the members informed in regard to the advances of philological science.

THE NATURAL SCIENCE CLUB OF THE LEHIGH UNIVERSITY.

The object of this organization is systematic study, in connection with field work, in natural history and its associated subjects. Its members are engaged in making a survey, both botanical and mineralogical, of the region within a radius of five miles from the University and propose to collect an herbarium and mineralogical cabinet which shall contain specimens of all the plants and minerals within this district.

THE LEHIGH UNIVERSITY CHRISTIAN ASSOCIATION.

This is a voluntary organization of the students for the promotion of the religious, moral, and social life in the University. It was organized April 18, 1890, and on Oct. 11, 1890, united itself with the Intercollegiate Young Men's Christian Association. The movement is distinctly for and by students, all the officers being chosen from the student body. Those connected with Evangelical churches of whatever creed are eligible to *active membership; associate membership* may be claimed by men of good moral standing

who are not members of churches. The association is continually growing, and is extending a marked influence for good among the men.

THE BIBLE CLASS.

A class for the reverent study of the sacred Scriptures, under the direction of the Chaplain, meets every Sunday afternoon at half past three o'clock. This class aims at both practical and theoretical results—the edification of its members in the Word of God, and the application of the (so-called) "scientific" or "historical" method to the study of Holy Writ.

FOUNDER'S DAY.

On the second Thursday of October of each year, Commemorative Exercises are held in honor of the Founder of the University.

UNIVERSITY SERMON.

This sermon is preached on the Sunday before University Day.

The Rt. Rev. Thomas Underwood Dudley, Bishop of Kentucky, was the preacher on Sunday, June 18, 1893, in the Memorial Church.

THESES.

Theses on the following subjects were prepared by candidates for degrees in 1893:

FOR THE DEGREE OF PH.D.

"A calorimetric study of copper."

JOSEPH WILLIAM RICHARDS, A.C., M.S.

FOR THE DEGREE OF M.A.

"The early relations between Egypt and the Greeks."

SAMUEL ERWIN BERGER, B.A.

"The character of the public oratory of Athens in the time of Demosthenes."

ELLIS ANSTETT SCHNABEL, B.A.

FOR THE DEGREE OF E.M.

"South Mountain glaciation."

JOSEPH BARRELL, B.S.

"The Mesabé Range."

CHARLES MERRITT CASE, B.S.

"Review of the ventilation law of Pennsylvania."

GEORGE PRICE CASE, B.S.

"Genesis of the Friedensville zinc ores."

GEORGE WASHINGTON ENGEL, B.S.

"Availability of the Plaza d'Oro gold field for hydraulic mining."

HENRY LEFEVRE, B.S.

"The Taylor gas producer with regenerative spelter furnace in use by The Lehigh Zinc and Iron Co."

HENRY LEWIS MANLEY, B.S.

"A calorimetric study of copper."

HENRY ORTH, JR., B.S.

FOR THE DEGREE OF B.A.

"Tiberius."

WALTER JOSEPH DECH.

"Oratory in the Odyssey."

CHARLES MALCOLM DOUGLAS.

"Lucretius's theories of the universe and life."

GEORGE STERN.

FOR THE DEGREE OF B.S.

"Frœbel, or the new education."

GILBERT FORBES BURNETT.

"Charlemagne."

GEORGE WILLIAM RITCHEY.

FOR THE DEGREE OF C.E.

"A review of span No. 27 of the western approach to the Walnut Street bridge, Philadelphia, Pa."

GEORGE HALDEMAN ATKINS.

"Design of a system of sewerage for South Bethlehem, Pa."

HUGH C. BANKS.

"Design for a high viaduct."

HERMAN RENNER BLICKLE.

"Experiments on the deflection of the catenary under concentrated loads."

WILLIAM IRVIN BOYD.

"The lateral deflection of columns."

FRED. EDGAR BRAY.

"Design for a lenticular parabolic highway bridge at Sellersville, Pa."

WARREN FELLMAN CRESSMAN.

"Experiments on pile driving, and a comparison of several formulas."

ROBERT FOSTER GADD.

"The draining of a bituminous coal mine."

LEE STOUT HARRIS.

"Design for a separate sewerage system at Freemansburg, Pa."

CLAUDE SANFORD HAYNES.

"Bricks and brick-making."

SCHUYLER BRUSH KNOX.

"The old bridge over the Lehigh River at Bethlehem, Pa."

CHARLES LOUIS MCKENZIE.

"Design for a steel highway bridge over the Lehigh River at Bethlehem, Pa."

GEORGE HOLBROOKE MAURICE.

"Design of a separate system of sewers for Allentown, Pa."

WILLIAM FREDERICK MYLANDER.

"Declination of the magnetic needle at South Bethlehem, Pa., and the local attraction at several stations in the L. U. triangulation."

CLINTON LEDYARD OLMSTEAD.

"Review of the sewerage system of Norfolk, Va."

NATHANIEL M. OSBORNE, JR.

"Comparison of three hinged arch and truss structure."

JOHN GATES PECK.

"Design for a draw bridge of two hundred and twenty feet span."

JOHN GRAHAM REID.

"Discussion of the water supply of Chevy Chase, Md."

EDWIN CLARK REYNOLDS.

"Design for a system of sewerage for Columbus, Miss."

FRANCIS EVANS RICHARDS.

"Review of the water supply of South Bethlehem, Pa."

MARTIN LUTHER SAULSBURY.

"Design and detail drawings of a camelback highway bridge. Span 180 feet."

ARMIN SCHOTTE.

"Discussion and comparison of railroad rail-joints."

NOEL W. SMITH.

"Survey and estimate for the construction of an electric railway from Washington, D. C., to Mount Vernon."

FRED. CONOVER WARMAN.

FOR THE DEGREE OF M.E.

"Experiments to determine the power absorbed by a 56-inch circular saw."

HENRY BROWN EVANS and
ROBERT CULBERTSON HAYS HECK.

"Kinematic analysis of the linotype machine."

GEORGE HARWOOD FROST.

"Traveling cranes."

CHARLES LINCOLN KELLER.

"Determination of the tangential pressures and co-efficients of unsteadiness of a 'Ball' and of a 'Corliss' compound engine."

JAMES EDGAR MILLER.

"The Archer gas fuel process."

DUNCAN WHITE PATTERSON.

"A cheap, efficient dust guard."

THOMAS HARRISON SYMINGTON.

FOR THE DEGREE OF B.S.

(IN METALLURGY.)

"A new process of reducing Franklinite ores, used at South Bethlehem, Pa.

NOBLE BANKS.

"The manufacture of open-hearth steel at Steelton, Pa."

ALEXANDER BEATTY SHARPE and
EDWARD AUGUSTUS SOLELIAC.

FOR THE DEGREE OF B.S.

(IN MINING.)

"The stripping system of mining anthracite coal, as practiced at Audenried, Pa."

HIRAM DRYER MCCASKEY.

FOR THE DEGREE OF E.E.

"Design, construction, and tests of an incandescent 20-light dynamo."

HARRY JACOBS ATTICKS.

"Life and efficiency tests of the Westinghouse stopper incandescent lamp."

CHARLES HAZARD DURFEE.

"Design, construction, and tests of a 500-watt closed magnetic circuit-transformer."

FREDERICK PARDEE FULLER.

"The Bethlehem division of the Allentown and Bethlehem Rapid Transit Co."

CHARLES WILLITS GEARHART.

"Construction and tests of a dynamo."

RICHARD WILLIS HEARD.

"Temperature coëfficient of aluminium."

WILLIAM PRICE MARR.

"The Washington and Mt. Vernon Electric Railway."

CHARLES JOSEPH O'NEILL.

"Electric welding and calculations, and design of an electric welder."

CHARLES WILLIAM PARKHURST.

"The Edison municipal system."

FREDERICK BRITTAN SAGE.

"The testing of telephone cables."

WILLIAM REMICK STINEMETZ.

"Electricity applied to pumping mine-water."

LEWIS ESLER TROUTMAN.

FOR THE DEGREE OF A.C.

"On a new disazo color, named Lehigh Lavender."

GEORGE EDWIN CHAMBERLAIN.

"Cotton seed and its products."
BERNARD ENRIGHT.

"The magnetic concentration of iron ores."
HARVEY HARTZELL GODSHALL.

"The bleaching of cotton cloth."
SAMUEL LAURY GRAHAM, JR.

"Alizarin."
FRANK SIGISMUND LOEB.

"Microscopic analysis of butter and lard."
RAYMOND BERNARD RANDOLH.

"Silicon."
JOSEPH A. SCHLOSS.

"The manufacture of oil of vitriol."
WILLIAM FREDERICK SEMPER.

"Tirconium."
JOHN TAYLOR, JR.

UNIVERSITY DAY.

This day is the last of the academic year, and falls in 1894 on the third Wednesday in June. On this day orations are delivered by members of the graduating class, and degrees are conferred.

EXERCISES ON JUNE 21, 1893.

Reading of Scripture and Prayer by the Rev. Elwood Worcester, Ph.D., Chaplain of the University.

Salutatory Oration.—"George Clark Rogers."
HENRY BROWN EVANS.

Oration.—"The Limitations of Knowledge."
HARRY JACOBS ATTICKS.

Oration.—"The Province of Poetry."
CHARLES MALCOLM DOUGLAS.

Oration.—"The Emancipation of the Mind."
GEORGE STERN.

Oration.—"Joan of Arc."
WALTER JOSEPH DECH.

Oration.—"Imagination and Science."
GEORGE HOLBROOKE MAURICE.

Valedictory Oration.
ROBERT CULBERTSON HAYS HECK.

Award of the Wilbur Scholarship to
WARREN BYRON KEIM,
of Reading, first in rank in Sophomore Class.

The Wilbur Prizes were awarded as follows:

Freshman Class, Mathematics, to

WARREN JOSHUA BIEBER, of Bethlehem.
MAXIMILIAN JOSEPH BUCHER, of Columbia.

Freshman Class, French, to
EDWARD COPPÉE THURSTON, of South Bethlehem.

Freshman Class, German, to
SAMUEL MOSES DESSAUER, of Montrose.

Freshman Class, Themes, to
WILLIAM STEWART AYARS, of Wilkes-Barre.

Freshman Class, Rhetoric, to
JOSEPH WHARTON THURSTON, of South Bethlehem.

Freshman Class, Freehand Drawing, to
DAVIS WILLIAM WILSON, JR., of Brooklyn, N. Y.

Freshman Class, General Chemistry, to
JAMES GEORGE BEACH, of Apalachin, N. Y.

The following Degrees were conferred:

M.A.

SAMUEL ERWIN BERGER, B.A.
ELLIS ANSTETT SCHNABEL, B.A.

E.M.

JOSEPH BARRELL, B.S.
GEORGE PRICE CASE, B.S.
GEORGE W. ENGEL, B.S.
HENRY LEFEVRE, B.S.
HENRY ORTH, JR., B.S.

B.A.

CHARLES MALCOLM DOUGLAS.
WALTER JOSEPH DECH.
GEORGE STERN.

B.S.

GILBERT FORBES BURNETT.
GEORGE WILLIAM RITCHEY.

C.E.

GEORGE HALDEMAN ATKINS.
HUGH CUNNINGHAM BANKS.
HERMAN RENNER BLICKLE.
WILLIAM IRVIN BOYD.
FREDERICK EDGAR BRAY.
WARREN FELLMAN CRESSMAN.
ROBERT FOSTER GADD.
LEE STOUT HARRIS.
CLAUDE SANFORD HAYNES.
SCHUYLER BRUSH KNOX.
CHARLES LOUIS McKENZIE.
GEORGE HOLBROOKE MAURICE.
WILLIAM FREDERICK MYLANDER.
CLINTON LEDYARD OLMSTED.
NATHANIEL MONTGOMERY OSBORNE, JR.
JOHN GATES PECK.
JOHN GRAHAM REID.
EDWIN CLARK REYNOLDS.
FRANCIS EVANS RICHARDS.
MARTIN LUTHER SAULSBURY.

ARMIN SCHOTTE.
NOEL W. SMITH.
FRED CONOVER WARMAN.

M.E.

HENRY BROWN EVANS.
GEORGE HARWOOD FROST.
ROBERT CULBERTSON HAYS HECK.
CHARLES LINCOLN KELLER.
JAMES EDGAR MILLER.
DUNCAN WHITE PATTERSON.
THOMAS HARRISON SYMINGTON.

B.S.

(IN METALLURGY.)

NOBLE BANKS.
ALEXANDER BEATTY SHARPE.
EDWARD AUGUSTUS SOLÉLIAC.

B.S.

(IN MINING.)

HIRAM DRYER McCASKEY.

E.E.

HARRY JACOBS ATTICKS.
CHARLES HAZARD DURFEE.
FREDERICK PARDEE FULLER.
CHARLES WILLITS GEARHART.
RICHARD WILLIS HEARD.
WILLIAM PRICE MARR.
CHARLES JOSEPH O'NEILL.
CHARLES WILLIAM PARKHURST.
FREDERICK BRITTAN SAGE.
WILLIAM REMICK STINEMETZ.
LEWIS ESLER TROUTMAN.

A.C.

GEORGE EDWIN CHAMBERLAIN.
BERNARD ENRIGHT.

HARVEY HARTZELL GODSHALL.
SAMUEL LAURY GRAHAM, JR.
FRANK SIGISMUND LOEB.
RAYMOND BERNARD RANDOLPH.
JOSEPH A. SCHLOSS.
WILLIAM FREDERICK SEMPER.
JOHN TAYLOR, JR.

THE WILBUR SCHOLARSHIP.

This Scholarship was founded in 1872 by E. P. Wilbur, Esq., of South Bethlehem, and is the sum of $200 awarded annually to the student in the Sophomore Class having the best record.

THE ALUMNI SCHOLARSHIP.

The Alumni Association of the University has established a Scholarship of the value of $250 per annum, subject to the following conditions:

1. That the Scholarship shall only be awarded to a student in need of it.

2. That the Scholarship shall not apply to the first year of any student's course; he must without this aid have gone through one year, and must be prepared to start the second year free from all conditions.

3. That the Scholarship shall not be continued to a student who shall at any time during his course carry any condition over eight weeks beyond the date of the examination in which he failed.

Subject only to the above conditions the disposal of the fund shall until otherwise directed be in the hands of the President of the University.

THE HENRY S. HAINES MEMORIAL SCHOLARSHIP.

Mrs. Henry S. Haines, of Savannah, Ga., has established a scholarship of the annual value of $200, which is to be devoted to the support at the Lehigh University, throughout his scholastic career, of one student in the School of Mechanical Engineering; the selection to be made by Mrs. Haines herself during her life-time.

WILBUR PRIZES.

By the generosity of E. P. Wilbur, Esq., a fund has been established, yielding an annual income of $100, for distribution in prizes as the Faculty shall determine.

ALUMNI PRIZES FOR ORATORY.

The "Alumni Association of the Lehigh University" has established an annual sum of Fifty Dollars, to be distributed as prizes for excellence in Oratory, subject to the following

REGULATIONS.

1. The Contest shall be held on the 22d day of February, or on the day designated by the University to commemorate the birthday of Washington.

2. There shall be a first prize of $25, a second of $15, and a third of $10.

3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.

4. Subjects for the oration shall be announced at the beginning of the first term of every year, and upon one of these each competitor shall write an oration not to exceed eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do —should they be sufficient in number—the best six shall be chosen, and their envelopes opened. The others shall be returned to the address given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by

them, shall hear the competitors whose orations shall have been approved, and the awards shall be made by a majority of these judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

At the last contest the competitors were as follows:

William Conklin Anderson, of New York City.
Robert Ferriday, of South Bethlehem.
Elwood Aristides Grissinger, of Mechanicsburg.
Arthur Williston Henshaw, of Amherst, Mass.
Barry Holme Jones, of Bethlehem.
Ruel Chaffee Warriner, of Montrose.

The First Prize was awarded to William Conklin Anderson; the Second, to Ruel Chaffee Warriner; the Third, to Robert Ferriday.

The next contest will take place February 22, 1894.

ENTRANCE EXAMINATION PAPERS.

Used for Examination in 1893.

[Requests for other examination papers than those herein printed can not be granted.]

I.—ENGLISH.

I. *a*) Illustrate the following constructions by sentences: —*Apposition*, *Nominative Independent*, *Indirect Object*.

b) State the character of each of your sentences: whether *loose* or *periodic*.

II. *a*) Write sentences illustrating the uses of *shall* and *will*, *would* and *should*—as fully as you can.

b) What do you understand by *Style?*

III. *a*) Which of these two sentences do you prefer:— *If I were he, I would do it in a minute;* or, *If I was he, I should do it in a minute?* State the reasons for your choice.

b) Criticise and correct the following sentences:—

He would better go; for, if he stays, he will meet some very disagreeable people.

He will find no one here when he will come.

IV. Punctuate and analyze the following sentence:—

When they arrived at the spot where he had agreed to meet them they sat in the little valley which was still green and through which flowed a shrunken shallow river wrinkled by the wind like the withered face of an old man and concluded to wait until he should come but although it was already late for the time which he had named was long passed they were far from impatient being well pleased at the opportunity of resting a while in so pleasant a place after the length of their journey and the extreme heat of the day for it was midsummer the time of the drought.

V. Write an essay of two hundred words on one of the following subjects:—

a) The plot of Shakespeare's *Henry the Eighth*.

b) The Boyhood of David Copperfield.

II.—GEOGRAPHY.

Outline maps of the central part of the United States and of Northern Europe, were furnished to each applicant and he was required to draw the boundaries of countries, provinces, states, and territories, and name them, to place and name the capital or chief city of each, and the principal rivers and mountain systems.

III.—UNITED STATES HISTORY.

1. *a*. What is meant by *charter government*, *proprietary government*, *royal government?*

   b. Under what form of government was Massachusetts settled?

   c. State what changes were afterwards made in the government, when and by whom they were made.

3. Which was the last important battle that settled the supremacy of the English over the French on the American continent?

4. Give an account of the leading events during Madison's administration.

5. What campaigns took place in 1863? Name the principal events of each.

6. When was arbitration in international questions first resorted to?

CONSTITUTION.

1. *a*. How are the members of each of the two branches of Congress chosen in the several States?

   b. How is the presiding officer of each branch chosen?

2. What is the last amendment to the Constitution?

3. What is the impeachment of a president? Who conducts it? Was any president impeached?

4. Who decides on the constitutionality of a law enacted by Congress?

IV.—ARITHMETIC.

I. (*a*) What is an odd number? an even number? a prime number? a factor? a multiple? common multiple of two or more numbers?

(*b*) State method of finding the least common multiple of two or more numbers.

(*c*) What is a fraction? How many kinds of fractions are there, and what are they?

II. (*a*) How is addition of common fractions performed? How is one fraction divided by another?

(*b*) How many feet in a metre? How many metres in a kilometre? How many pints in a litre? How many litres in a hectolitre?

(*c*) What are stocks and bonds? When are they said to be at par? at a premium? at a discount?

III. In 10 gallons 3 quarts $1\frac{1}{3}$ pints, how many litres?

IV. 25 is 25 per cent of what number? $\frac{1}{5}$ is $\frac{1}{5}$ per cent of what number?

V. Find interest, discount, and bank discount on $25.00 for 60 days at $4\frac{1}{2}$ per cent.

VI. A cylindrical cistern has the following dimensions: diameter $2\frac{1}{2}$ metres, depth $3\frac{1}{4}$ metres. How many gallons of water will it contain?

V.—GEOMETRY.

I. (*a*) Define geometry; a theorem; a corollary; a lemma; a postulate.

(*b*) What is a surface? a plane surface? a curved surface?

(*c*) What is a locus? and give an illustration.

(*d*) What are the segments of a line? the segments of a circle?

(*e*) When are two points symmetrical with respect to an axis? When is a polygon symmetrical with respect to a centre?

II. (*a*) What is a proportion? a continued proportion? When is a proportion said to be taken by alternation? by inversion? by composition? by division? Illustrate.

(*b*) When is a straight line said to be divided harmonically?

(*c*) What are similar polygons? The conditions which render two triangles similar? The ratio of similitude of similar polygons?

(*d*) What is the area of a circular sector? Of a circle in terms of its radius? The ratio of the areas of two circles?

(*e*) What is meant by the angle included between two straight lines in space which do not intersect? The plane angle of a diedral angle?

III. The three medial lines of a triangle pass through a common point.

IV. If the opposite sides of a quadrilateral are equal, or if the opposite angles are equal, the figure is a parallelogram.

V. The angles at the centre of a circle are proportional to their intercepted arcs when the arcs are commensurable, also when they are incommensurable.

VI. Find the square of a side of a triangle opposite an obtuse angle.

VII. Construct a polygon similar to a given polygon, the ratio of similitude being 3 to 2.

VIII. The ratio of the areas of triangles having an angle common is the ratio of the products of the sides about the common angle.

IX. Given the perimeters of inscribed and circumscribed regular polygons of the same number of sides, to compute the perimeters of inscribed and circumscribed regular polygons of double the number of sides.

X. In a triedral angle any face-angle is less than the sum of the other two.

VI.—ALGEBRA.

1. (*a*) Define terms; factors; coëfficients; exponents.

   (*b*) When is a monomial radical in its simplest form, and what are the conditions under which a radical may be simplified?

   (*c*) Define a system of notation, and state some advantages of a literal notation over a numerical.

2. (*a*) Define an arithmetical and a geometrical progression, and write the formulæ for determining l and s in a geometrical progression.

   (*b*) State rule for finding lowest common multiple of several quantities that are readily factored; also of two quantities that are not easily factored.

   (*c*) Write the general form of a quadratic equation, and the value of x in such equation.

3. (*a*) State the conditions under which a binomial may be resolved into binomial factors, and the character of the factors in each case.

   (*b*) When are four quantities said to be proportional? When are three quantities said to be proportional? When are two quantities said to be proportional?

   (*c*) Define a proposition; a theorem; a problem.

4. Divide $\frac{x^3}{y^3}+\frac{5x^2}{12y^2}+\frac{39}{16}$ by $\frac{x}{3y^2}+\frac{1}{2y}$ without reducing. Rationalize the denominator of $\frac{2}{\sqrt{3}+\sqrt[3]{4}}$.

5. Resolve x^6+y^6; x^6-y^6; x^2-y^2+2x+1; $x^2-y^2+2xy\sqrt{-1}$; $1-x+x^2-x^3$ into prime factors.

6. Solve the following:

   $\frac{2x-1}{\sqrt{2x+1}}=\frac{\sqrt{2x-1}}{2}+2$; (verify.) $\sqrt{x+x^2}-x=\frac{1}{3}$.

7. A certain number of two digits equals three times their sum, and if 45 be added to it the digits are reversed. Required, the number.

8. Solve the following:

$$\sqrt{1+x^2}+\sqrt{1+x^2+\sqrt{1-x^2}}=\sqrt{1-x^2}. \quad \frac{x+\sqrt{x}}{x-\sqrt{x}}=\frac{3\sqrt{x}+6}{2\sqrt{x}}; \text{ (verify.)}$$

9. A rectangular plot of ground whose width is $\frac{2}{3}$ its length has a 4-foot walk around it, and the area of the walk equals that of the plot. Required, the dimensions of the plot.

10. Solve the following:

$$x-y=1; \qquad x^2+xy=12;$$
$$x+\sqrt{x^2-y^2}=8. \qquad xy-2y^2=1.$$

VII.—PHYSICS.

1. Define:

a. C. G. S. units.
b. Gravitation.
c. Compound pendulum.
d. Machine.
e. Farad.
f. Electrostatic unit of quantity.
g. Induced currents.
h. Astatic needle.
i. Resonance.
j. Beats.
k. Thermal unit.
l. Radiant heat.
m. Mechanical equivalent of heat.
n. Polarized light.
o. Refraction of light.

2. Derive the formulae for kinetic energy and for velocity of a liquid issuing from an orifice.

3. A body weighing 1000 lbs. is rolled down an inclined plane 2000 ft. long and 500 ft. high; find (1) its final velocity, (2) amount of ice at —10°C., its kinetic energy can convert into steam at 125°C. (Sp. ht. ice = .505; sp. ht. of steam = .4805).

4. A piece of metal weighs 14.3 g. in air, 11.3 g. in benzine (sp. gr. 8.8); what is (1) its specific gravity, (2) its weight in turpentine (sp. gr. .85), (3) its weight in air, (4) its volume?

5. How long must a current of 10 amperes flow through a wire weighing 5 g., having a resistance of 10 ohms, immersed in 10 g. of alcohol, to raise the temperature of the wire and of the alcohol from 0° to 10°C? (Sp. ht. of wire .0324; sp. ht. of alcohol .505.)

6. A certain string vibrates 100 times a second. With how much weight must a string of the same material, but twice the weight per linear unit, and three times as long be stretched to vibrate 200 times per second?

7. What will be the resulting temperature of the following mixture:

10 lbs. ice at — 10° (sp. ht. .505),
2 lbs. steam at 110° (sp. ht. .4805),
10 lbs. of water at 100°?

8. How could the specific heat of a piece of copper be found experimentally?

9. Describe the Fahrenheit hydrometer and tell how it is used.

10. Describe the Daniell's battery.

11. Explain how you convert temperatures given in centigrade degrees to Fahrenheit and conversely.

12. Tell the kind of image, real or virtual, erect or inverted and at what place formed with a convex lens when the object is at

a. principal focus,
b. between focus and lens,
c. between focus and center of curvature,
d. at center of curvature,
e. beyond center of curvature.

VIII.—PHYSICAL GEOGRAPHY.

1. Name the motions of the earth and tell what they produce.

2. Give the classification of islands and name an example of each.

3. Describe the principal waterfalls and caves.

4. Name the oceanic movements and give their causes and the effects they produce.

5. Explain the origin of land and sea breezes.

6. Explain the formation of rain, hail, snow, dew, and fog.

7. Name some of the optical phenomena of the atmosphere.

8. Name and locate the most important minerals of the United States.

9. What difference exists between the climate of the eastern and the western coasts of the United States?

10. When do the heaviest rains occur in the Atlantic States, and in what part of our country have we the heaviest rainfall?

IX.—LATIN.

Inflect in full: Imber, dea, deus, saltus, senex, fides; ferox, nullus, major, frugi, amans, mille; aliquis, idem.

Give the gender of alvus (belly), nauta, dies, nomen, with the reason for each.

Compare nequam, exterus, carus and idoneus.

Give the complete synopsis of soleo and nitor; and the principal parts of tono, cano, tondeo, teneo, and tollo.

Inflect the present tense of fio and possum.

Explain the meaning of the endings in the words ovile, vivarium, cantor, and Sullanus.

What are inceptive and frequentative verbs, and how are they formed?

State the use of the supine in u.

Describe, with examples, the various ways in which purpose is expressed in Latin.

What are the independent uses of the subjunctive?

What particles are employed in asking questions and how do they differ?

How do you render into Latin "I fear that he will die?"

Translate:

I. Caesar singulis legionibus singulos legatos et quaestorem praefecit, uti eos testes suae quisque virtutis habe-

ret; ipse a dextro cornu, quod eam partem minime firmam hostium esse animadverterat, proelium commisit. Ita nostri acriter in hostes, signo dato, impetum fecerunt, itaque hostes repente celeriterque procurrerunt, ut spatium pila in hostes coniciendi non daretur. Rejectis pilis, cominus gladiis pugnatum est. At Germani celeriter, ex consuetudine sua phalange facta, impetus gladiorum exceperunt.

Explain the syntax of legionibus, haberet, gladiis.

II. Ubii autem, qui uni ex Rhenanis ad Caesarem legatos miserant, amicitiam fecerant, obsides dederant, magnopere orabant ut sibi auxilium ferret, quod graviter ab Suevis premerentur; vel, si id facere occupationibus reipublicae prohiberetur, exercitum modo Rhenum transportaret: id sibi ad auxilium spemque reliqui temporis satis futurum. Tantum esse nomen atque opinionem ejus exercitus, Ariovisto pulso et hoc novissimo proelio facto, etiam ad ultimas nationes, uti opinione et amicitia populi Romani tuti esse possint. Navium magnam copiam ad transportandum exercitum pollicebantur.

Point out what principles of the indirect discourse are illustrated in this passage. How is Rhenum governed? What is the syntax of reliqui temporis?

III. Est mihi tanti, Quirites, hujus invidiae falsae atque iniquae tempestatem subire, dum modo a vobis hujus horribilis belli ac nefarii periculum depellatur. Dicatur sane ejectus esse a me, dum modo eat in exsilium. Sed, mihi credite, non est iturus. Numquam ego a dis immortalibus optabo, Quirites, invidiae meae levandae causa, ut L. Catilinam ducere exercitum hostium atque in armis volitare audiatis: sed triduo tamen audietis; multoque magis illud timeo, ne mihi sit invidiosum aliquando, quod illum emiserim potius quam quod ejecerim.

What is the syntax of tanti, and causa?

IV. Majores nostri saepe mercatoribus aut navicularis nostris injuriosius tractatis bella gesserunt: vos, tot milibus civium Romanorum uno nuntio atque uno tempore necatis,

quo tandem animo esse debetis? Legati quod erant appellati superbius, Corinthum patres vestri totius Graeciae lumen exstinctum esse voluerunt: vos eum regem inultum esse patiemini, qui legatum populi Romani consularem vinculis ac verberibus atque omni supplicio excruciatum necavit? Illi libertatem imminutam civium Romanorum non tulerunt: vos ereptam vitam neglegetis?

V. Hic aliud maius miseris multoque tremendum
obicitur magis, atque improvida pectora turbat.
Laocoön, ductus Neptuno sorte sacerdos,
sollemnis taurum ingentem mactabat ad aras.
Ecce autem gemini a Tenedo tranquilla per alta—
horresco referens—immensis orbibus angues
incumbunt pelago, pariterque ad litora tendunt;
pectora quorum inter fluctus arrecta iubaeque
sanguineae superant undas; pars cetera pontum
pone legit, sinuatque immensa volumine terga.

Write out the first three lines, indicating the feet and the caesural pause.

VI. Iamque propinquabant scopulo metamque tenebant,
cum princeps medioque Gyas in gurgite victor
rectorem navis compellat voce Menoeten:
'Quo tantum mihi dexter abis? Huc dirige gressum;
litus ama, et laevas stringat sine palmula cautes;
alum alii teneant.' Dixit; sed caeca Menoetes
saxa timens proram pelagi detorquet ad undas.
'Quo diversus abis?' iterum 'Pete saxa, Menoete!'
cum clamore Gyas revocabat; et ecce Cloanthum
respicit instantem tergo, et propiora tenentem.

VII. Caesar, ut Brundisium venit, contionatus apud milites, quoniam prope ad finem laborum ac periculorum esset perventum, aequo animo mancipia atque impedimenta in Italia relinquerent, ipsi expediti naves conscenderent, quo maior numerus militum posset imponi, omniaque ex victoria et ex sua liberalitate sperarent, conclamantibus omnibus, imperaret, quod vellet, quodcumque imperavisset, se aequo animo esse facturos, II Non. Ian. naves solvit.

Translate into Latin:

Caesar sent Titus Labienus, his lieutenant, to make an attack upon the camp of the enemy. He, having drawn up a line of battle, gave the enemy an opportunity of fighting immediately, and the forces of the Gauls did not dare to come out of their own camp. After three days, when he saw that he could not persuade them to fight, he led his soldiers back to the army.

Many writers have praised the genius of Caesar, and he is to be regarded as the greatest commander that Rome ever produced. Even today we read his commentaries with admiration and interest.

Roman History.

1. Give the names of the kings, and state what each is said to have done.
2. Narrate the life of Marius.
3. Mention the chief steps in the struggle between the patricians and plebeians for the possession of political power.
4. Who formed the two triumvirates, and what battles were fought between them and their adversaries?
5. Give the life of Cicero.

X.—GREEK.

I. Grammar.

1. Write the following passage with proper accents and breathings:

ωετο δε αρκειν προς το αρχικον ειναι και δοκειν τον μεν καλως ποιοντα επαινειν, τον δε αδικουντα μη επαινειν. τοιγαρουν αυτω οι μεν καλοι τε καγαθοι των συνοντων ευνοι ησαν, οι δε αδικοι επεβουλευον ως ευμεταχειριστῳ οντι. οτε δε απεθνησκεν ην ετων ως τριακοντα.

2. Decline throughout *πολίτης, νοῦς, σώφρων* (both genders): through the singular, *μοῦσα, ὁδός, βοῦς, ἠχώ*: through the plural, *πόλις, εὐγενής* (both genders), *χαρίεις* (three genders).

3. Compare the adjectives *μικρός, πολύς, ἐχθρός*; the adverb *μάλα*.

4. Give the Greek words for *six*, *tenth*, *four times*; decline the words for *two*, *three*.

5. Give the principal parts of *αἱρέω*, *φέρω*, *τάττω*; the synopsis (*i.e.*, first form of each mode) of the aorist, active middle and passive, of *ἵημι*; the inflection through the numbers and persons of the perfect indicative, active and middle, of *πράττω*, and the imperfect indicative, active and middle, of *ὁράω*; the present participle, dative plural, of *τίθημι*.

6. Decline *τοιοῦτος*; translate *to us*, *of ourselves*, *which* (*of two*)*?*, *how much?*, *somewhere*, *when?*

7. Name three classes of verbs that govern the dative; five prepositions that govern both genitive and dative, giving their meanings with each case.

8. What is the meaning of the subjunctive when used in an independent sentence? of the optative?

9. *ἐὰν Κῦρος ἔλθῃ, αὐτὸν ὀψομαι*; *εἰ Κῦρος ἦλθεν, αὐτὸν ἂν εἶδον.* Translate these two sentences and explain the difference between them.

10. *τοῦτο ποιήσας ἀπέθανε*; *ὁ τοῦτο ποιήσας ἀπέθανε*; *δῆλος ἦν τοῦτο ποιήσας.* Translate and explain the different uses of the participle.

II. Xenophon.

1. *Translate:*

Παρεκάλεσα ὑμᾶς, ἄνδρες φίλοι, ὅπως σὺν ὑμῖν βουλευόμενος ὅ,τι δίκαιόν ἐστι καὶ πρὸς θεῶν καὶ πρὸς ἀνθρώπων, τοῦτο πράξω περὶ Ὀρόντα τουτονί. τοῦτον γὰρ πρῶτον μὲν ὁ ἐμὸς πατὴρ ἔδωκεν ὑπήκοον εἶναι ἐμοί· ἐπεὶ δὲ ταχθείς, ὡς ἔφη αὐτός, ὑπὸ τοῦ ἐμοῦ ἀδελφοῦ οὗτος ἐπολέμησεν ἐμοὶ ἔχων τὴν ἐν Σάρδεσιν ἀκρόπολιν, καὶ ἐγὼ αὐτὸν προσπολεμῶν ἐποίησα ὥστε δόξαι τούτῳ τοῦ πρὸς ἐμοῦ πολέμου παύσασθαι, καὶ δεξιὰν ἔλαβον καὶ ἔδωκα.

Explain the construction of *πράξω*, *δόξαι*, *πολέμου*.

2. *Translate:*

Καὶ Ξενοφῶν μὲν καὶ οἱ σὺν αὐτῷ εἰπόντες τοῖς ἀσθενοῦσιν, ὅτι τῇ ὑστεραίᾳ ἥξουσί τινες ἐπ' αὐτούς, πορευόμενοι πρὶν τέτταρα στάδια διελθεῖν ἐντυγχάνουσιν ἐν τῇ ὁδῷ ἀναπανομένοις ἐπὶ τῆς χίονος τοῖς στρατι-

ὥταις ἐγκεκαλυμμενοις, καὶ οὐδὲ φυλακὴ οὐδεμία καθειστήκει· καὶ ἀνίστασαν αὐτούς. οἱ δ' ἔλεγον, ὅτι οἱ ἔμπροσθεν οὐχ ὑποχωροῖεν. ὁ δὲ παριὼν καὶ προπέμπων τῶν πελταστῶν τοὺς ἰσχυροτάτους ἐκέλευσε σκέψασθαι, τί εἴη τὸ κωλῦον. οἱ δ' ἀπήγγελλον, ὅτι ὅλον οὕτως ἀναπαίοιτο τὸ στράτευμα.

Explain the construction of *διελθεῖν*, *ὑποχωροῖεν*, *εἴη*. Where is *ἀνίστασαν* made? *κωλῦον*?

III. Xenophon, at sight.

Κατανενόηκας, ἔφη, ὦ Περίκλεις, ὅτι πρόκειται τῆς χώρας ἡμῶν ὀρη μεγάλα, καθήκοντα ἐπὶ τὴν Βοιωτίαν, δι' ὧν εἰς τὴν χώραν εἴσοδοι στεναί τε καὶ προσάντεις εἰσίν; Καὶ μάλα, ἔφη. ἐκεῖνο δ' ἀκήκοας, ὅτι Μυσοὶ καὶ Πισίδαι ἐν τῇ βασιλέως χώρᾳ κατέχοντες ἐρυμνὰ πάνυ χωρία καὶ κοίφως ὡπλισμένοι δύνανται πολλὰ μὲν τὴν βασιλέως χώραν καταθέοντες κακοποιεῖν, αὐτοὶ δὲ ζῆν ἐλεύθεροι.

κατανοέω, observe. *πρόκειμαι*, lie in front of.
προσάντης, steep. *καὶ μάλα*, yes, indeed.

IV. Homer.

1. *Translate:*

εὕδεις, Ἀτρέος υἱὲ δαίφρονος ἱπποδάμοιο·
οὐ χρὴ παννύχιον εὕδειν βουλήφορον ἄνδρα,
ᾧ λαοί τ' ἐπιτετράφαται καὶ τόσσα μέμηλεν.
νῦν δ' ἐμέθεν ξύνες ὦκα· Διὸς δέ τοι ἄγγελός εἰμι,
ὅς σευ ἄνευθεν ἐὼν μέγα κήδεται ἠδ' ἐλεαίρει.
θωρῆξαί σ' ἐκέλευσε κάρη κομόωντας Ἀχαιοὺς
πανσυδίη· νῦν γάρ κεν ἕλοις πόλιν εὐρυάγυιαν
Τρώων·

By whom were these words uttered? To whom? With what result?

Give the Attic forms of *Ἀτρέος*, *ἐπιτετράφαται*, *ἐμέθεν*, *ἐὼν*.

Where is *ξύνες* made? From what present?

2. *Translate:*

ὄρσεο, Λαομεδοντιάδη, καλέουσιν ἄριστοι
Τρώων θ' ἱπποδάμων καὶ Ἀχαιῶν χαλκοχιτώνων
ἐς πεδίον καταβῆναι, ἵν' ὅρκια πιστὰ τάμητε.
αὐτὰρ Ἀλέξανδρος καὶ ἀρηΐφιλος Μενέλαος
μακρῇς ἐγχείῃσι μαχήσουτ' ἀμφί γυναικί·
τῷ δέ κε νικήσαντι γυνὴ καὶ κτήμαθ' ἕποιτο.

3. *Arrange in a hexameter line:*
Μενοιτιάδη, ἑτάροισιν, ἤιε, οἷς, σύν, καί, τε.

V. History.

1. State what you know of the governments of Athens and of Sparta at the time of the outbreak of the Peloponnesian War.

2. What changes of government took place in Greece between the Homeric and the historic periods?

3. Arrange in chronological order: Alexander the Great, Aristotle, Miltiades, Pericles, Plato, Socrates, Solon.

4. By how many years did Cyrus the Great precede the younger Cyrus? What was the relationship between them? What claim had the younger Cyrus to the throne?

5. Tell the story of the Athenian Expedition against Syracuse.

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Of these, 1 has taken the degrees of B.A. and B.M.; 9 of B.A. and M.A.; 2 of B.S. and C.E.; 1 of B.S. and A.C.; 11 of B.M. and E.M.; 27 of B.S. and E.M.; 1 of B.M., E.M., and A.C.; 1 of B.S., E.M., and C.E.; 1 of C.E. and E.M.; 2 of A.C. and E.M.; 1 of A.C., M.S., and Ph.D. 558 graduates are still living.

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OF

THE LEHIGH UNIVERSITY,

SOUTH BETHLEHEM, PA.

1894-1895.

FOUNDED BY ASA PACKER.

BETHLEHEM, PA.:
TIMES PUBLISHING COMPANY.
1894.

TABULAR ALMANAC.

1894.

JULY.

S	M	T	W	T	F	S
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1895.

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1896.

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CALENDAR.

1894.	1894-1895.	
Sept. 8, 10, 11,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 12,	Wednesday, . .	First Term begins.
Oct. 11,	Thursday, . .	Founder's Day.
Nov. 29,	Thursday, . .	Thanksgiving Day.
Dec. 19,	Wednesday, .	First Term ends.
1895.		
Jan. 8, 9,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 9,	Wednesday, .	Second Term begins.
Jan. 19,	Saturday, . .	Junior Prize Orations due.
Feb. 27,	Wednesday, .	Ash Wednesday.
Feb. 22,	Friday, . .	Washington's Birthday.
April 11,	Thursday, . .	Easter Holidays begin.
April 16,	Tuesday, . .	Easter Holidays end at $8\frac{1}{4}$ A.M.
May 27,	Monday, . .	University Day Orations due.
May 29,	Wednesday, . .	Theses of Seniors due.
May 29,	Wednesday, .	Senior Examinations begin.
June 10,	Monday, . . .	Annual Examinations begin.
June 16,	Sunday, . .	Baccalaureate Sermon.
June 17,	Monday, . .	Class Day.
June 19,	Wednesday, .	University Day.
Jun. 20, 21, 22,	Thursday, Friday, and Saturday,	Examinations for Admission.
1895.	**1895-1896.**	
Sept. 7, 9, 10,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 11,	Wednesday, . .	First Term begins.
Oct. 10,	Thursday, . .	Founder's Day.
Nov. 28,	Thursday, . .	Thanksgiving Day.
Dec. 18,	Wednesday, .	First Term ends.
1896.		
Jan. 7, 8,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 8,	Wednesday, . .	Second Term begins.
June 17,	Wednesday, .	University Day.

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Instructor in Mathematics.

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Acting Chaplain,
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Organist,
J. FRED. WOLLE,
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Shelf Clerk,
PETER F. STAUFFER.

† Absent for one year by permission.

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Sci.—Science and Letters.
A.C.—Analytical Chemistry.
C.E.—Civil Engineering.
E.M.—Mining Engineering.
M.E.—Mechanical Engineering.
E.E.—Electrical Engineering.
Arch.—Architecture.

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Wm. N. R. Ashmead, B.A.,	M.A.,	Philadelphia.
John Young Bassell, jr., B.S.,	E.M.,	St. Louis, Mo.
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Harlan Sherman Miner, A.C.,	M.S.,	Gloucester, N. J.
Howard Segar Neiman, A.C.,	M.S.,	Albany, N. Y.
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Alexander Potter, C.E.,	M.S.,	New York City.
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Ira A. Shimer, B.A.,	M.A.,	Philadelphia.
Philip Henry Smith, E.E.,	M.S.,	Pittsburg.
Charles H. Thompson, B.S.,	E.M.,	Berryville, Va.

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Chester Terrill Ayres,	E.E.,	Williamsport.
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Clarence Kemble Baldwin,	M.E.,	Philadelphia.
Anthony Francis Bannon, jr.,	C.E.,	Bradford.
John Collinson Barber,	C.E.,	Conaways, Md.
Robert Josiah Bartholomew,	M.E.,	Bath.
Rollin Calvert Bastress,	C.E.,	Sunbury.
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James Emery Brooks,	M.E.,	East Orange, N. J.
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William Henry Brown,	E.M.,	Yatesville.
Walter Turpin Brown,	C.E.,	Centreville, Md.
James Hodgson Budd,	C.E.,	Middletown, Del.
Charles Calvin Burgess,	C.E.,	Flemington, N. J.
John Thomas Callaghan, jr.,	E.M.,	Washington, D. C.
Francis Lee Castleman,	C.E.,	Gaylord, Va.
Thomas Francis Carroll,	Sci.,	Towanda.
*Robert Edes Chetwood, jr.,	E.E.,	Elizabeth, N. J.
Arthur Stebbins Clift,	M.E.,	Croton Falls, N. Y.
*Edward Perrine Cody,	C.E.,	Philadelphia.
William Wheeler Coleman,	E.M.,	Baltimore, Md.
William Joseph Collier,	C.E.,	Duncannon.
Morris Llewellyn Cooke,	M.E.,	Orange, N. J.
Herbert Maurice Crawford,	C.E.,	Manorville.
Henry M. S. Cressman,	Clas.,	Sellersville.
Howard Stephen Dech,	M.E.,	Bethlehem.
Henry De Huff,	E.E.,	Lebanon.
Stanley Chipman de Witt,	E.E.,	Halifax, N. S.
James Chambers Dick,	C.E.,	Brockwayville.
*Beekman Dubarry, jr.,	M.E.,	Washington, D. C.

* Not clear of conditions.

	Course.	Residence.
Howard Eckfeldt,	E.M.,	Conshohocken.
Alfred Wm. Alexander Eden,	C.E.,	Brown's Town, Jamaica.
Edward L. Faison, jr.,	C.E.,	Elliott, N.C.
Guy Hector Farman,	E.M.,	Westfield, Vt.
Edward Calvin Ferriday,	Clas.,	South Bethlehem.
Walter Ferris,	M.E.,	Wilmington, Del.
Richard Daniel Floyd,	A.C.,	Milton, Mass.
George Lane Gabrio,	E.E.,	Hazleton.
*Andres Garza Galan,	C.E.,	Saltillo, Mex.
Eduardo Antonio Giberga,	M.E.,	Matanzas, Cuba.
John Jameson Gibson,	E.E.,	York.
Elmer Grant Godshalk,	A.C.,	Lansdale.
Wallace Russell Goss,	C.E.,	Union, S. C.
Frederick Taylor Haines,	C.E.,	Elkton, Md.
Thomas Graham Hamilton,	E.E.,	Pittsburg.
Robert Rieman Harvey,	E.E.,	Wilkes-Barre.
Thomas Lloyd Henry,	C.E.,	Troy, N. Y.
Howard Samuel Hess,	Clas.,	Hellertown.
Ira Miller Higbee,	C.E.,	Watsontown.
William Jacob Hiss, jr.,	E.E.,	Orange, N. J.
William Hopkins,	E.E.,	Washington, D. C.
Drew William Irvine,	E.E.,	Columbia, Tenn.
Charles Borrows Jacobs,	A.C.,	Tyler.
Elmer Augustus Jacoby,	Clas.,	Locust Valley.
William Agassiz James,	E.M.,	Wilkes-Barre.
Henry Scudder Jaudon,	C.E.,	Savannah, Ga.
Albert Beardsley Jessup,	E.M.,	Scranton.
Elisha Barton John,	C.E.,	Bloomsburg.
*Victor Albert Johnson,	E.M.,	St. Paul, Minn.
Henry Harrison Jones,	C.E.,	Reading.
Adolph Somers Kappella,	E.E.,	Philadelphia.
*Dixon Kautz,	L.S.,	Moweaqua, Ill.
Warren Byron Keim,	C.E.,	Reading.
Henry Edward Kip,	Arch.,	Buffalo, N. Y.
David Henshey Lackey,	E.E.,	Altoona.
William Allen Lambert,	Clas.,	Hellertown.
Louis Edgar Lannan,	E.E.,	Washington, D. C.

* Not clear of conditions.

	Course.	Residence.
Arthur Hughes Lewis,	E.M.,	Plains.
Gerald Lewis,	A.C.,	Milford.
*Benjamin W. Loeb,	A.C.,	Reading.
*Philip Theodore Lovering,	E.E.,	Minneapolis, Minn.
Robert A. McKee,	M.E.,	Towanda.
Fayette Avery McKenzie,	Sci.,	Montrose.
Stuart Tuttle McKenzie,	C.E.,	Montrose.
Norman Peach Massey,	C.E.,	Chestertown, Md.
Charles Frazier Maurice,	C.E.,	Athens.
John Samuel Miller,	M.E.,	Harrisburg.
Walter Henry Miller,	M.E.,	Osage City, Kan.
*Archibald D. Morris,	M.E.,	Bristol.
Eugene Mowlds,	C.E.,	West Conshohocken.
William Spencer Murray,	E.E.,	Annapolis, Md.
Robert Neilson, Jr.,	C.E.,	Williamsport.
Walter R. Okeson,	C.E.,	Bethlehem.
Charles B. Pennell,	M.E.,	Duncannon.
James Harry Philips,	C.E.,	Atglen.
*Joseph Phillips, Jr.,	E.M.,	Nashville, Tenn.
John Livingston Poultney,	M.E.,	Baltimore, Md.
Henry Crider Quigley,	E.E.,	Harrisburg.
William Reinecke, Jr.,	Arch.,	Louisville, Ky.
Eugene Jesse Rights,	C.E.,	Tahlequah, Ind. T'y.
Herbert Timothy Rights,	C.E.,	Tahlequah, Ind. T'y.
*Samuel Neely Riter,	M.E.,	Pittsburg.
Eugene Schwinghammer,	E.E.,	Washington, D. C.
Harry Kent Seltzer,	C.E.,	Ephrata.
John Egbert Shero,	A.C.,	Fredonia, N. Y.
Robert S. Siegel,	Clas.,	Bethlehem.
Edwin Harrison Sigison,	E.E.,	Buffalo, N. Y.
John Blake Slack,	E.E.,	Paducah, Ky.
Robert Eugene Smith,	M.E.,	West Bethlehem.
Edward George Steinmetz,	E.E.,	Philadelphia.
John Eugene Stocker,	Sci.,	Bethlehem.
Herbert Ridley Stratford,	A.C.,	Jersey City, N. J.
Robert Melvin Tarleton,	E.M.,	Baltimore, Md.

*Not clear of conditions.

	Course.	Residence.
Robert Sayre Taylor,	Sci.,	Bethlehem.
*Nathaniel Thurlow,	A.C.,	Lancaster.
Charles Frederick Townsend,	Arch.,	Willimantic, Conn.
Joseph Boyer Townsend,	E.E.,	Venetia.
*Frederick John Van Benthem van den Bergh,	C.E.,	Arnhem, Holland.
Willard Randolph Van Liew,	E.M.,	Neshanic, N. J.
*Geo. Brinkerhoff Van Riper,	A.C.,	Rutherford, N. J.
Charles Henry Vansant,	C.E.,	Eddington.
William Warr,	E.E.,	Philadelphia.
Harry Dallam Webster,	M.E.,	Baltimore, Md.
Fred Irving Wheeler,	C.E.,	Pawtucket, R. I.
Harry Amasa White,	E.E.,	Philadelphia.
John Crum Whitmoyer,	E.E.,	Harrisburg.
Edward Newton Wigfall,	A.C.,	Philadelphia.
John Marion Wilson,	C.E.,	Hillsboro, Md.
Harold Lawden Wood,	A.C.,	Upper Montclair, N.J.
*Carlos Yglesias,	E.M.,	San José, Costa Rica, [C.A.
†Harry Bernard Zimmele,	A.C.,	Bethlehem.

JUNIOR CLASS.

William James Adams,	E.E.,	Harrisburg.
William Stewart Ayars,	M.E.,	Wilkes-Barre.
Hobart Bentley Ayers,	M.E.,	Westerly, R. I.
Albert Doane Ayres,	C.E.,	Williamsport.
Arthur Davison Badgley,	E.E.,	South Bethlehem.
Francis Hoskins Baldwin,	E.E.,	New Haven, Conn.
Hasell Wilson Baldwin,	M.E.,	Zanesville, O.
Lewis Warrington Baldwin,	C.E.,	Waterbury, Md.
Springfield Baldwin,	C.E.,	Baltimore, Md.
Geo. Pomeroy Bartholomew,	E.M.,	Jeanesville.
*Frederic Bartles,	C.E.,	Williamsport.
Charles C. W. Bauder,	E.E.,	Rheims, N. Y.
Fairfax Bayard,	C.E.,	Washington, D. C.
James George Beach,	Arch.,	Apalachin, N. Y.
Herbert Huebener Beck,	A.C.,	Lititz.

*Not clear of conditions.
† Excused.

	Course.	Residence.
Samuel Edward Beeler,	M.E.,	Hagerstown, Md.
*Edgar Tweedy Belden,	C.E.,	Stamford, Conn.
*Moriz Bernstein,	C.E.,	Philadelphia.
Warren Joshua Bieber,	Clas.,	Bethlehem.
Daniel William Bliem,	C.E.,	Pottstown.
*Benjamin Franklin Bossert,	C.E.,	Phœnixville.
Howard Franklin Boyer,	Sci.,	Springtown.
Edward Elisha Bratton,	C.E.,	Lewistown.
Frank Shepard Bromer,	M.E.,	Schwenksville.
Maximilian Joseph Bucher,	A.C.,	Columbia.
George Amandus Buvinger,	M.E.,	Dayton, O.
Aaron Beaumont Carpenter,	E.E.,	Avondale.
Malcolm Carrington,	E.E.,	Richmond, Va.
Frank Leslie Cooke,	E.F.,	Hackettstown, N. J.
Eckley Samuel Cunningham,	M.E.,	Drifton.
Samuel Philip Curtis,	M.E.,	Penn Yan, N. Y.
Frederick Allyn Daboll,	C.E.,	Plainfield, N. J.
John William Dalman,	M.E.,	Fort Wayne, Ind.
Lewis Benjamin Davenport,	C.E.,	Baltimore, Md.
*Robert Adriance Davidson,	E.E.,	Northport, L. I.
Samuel Moses Dessauer,	Arch.,	Montrose.
William Carter Dickerman,	M.E.,	Milton.
Benjamin Irvin Drake,	E.M.,	South Bethlehem.
Frank Oliver Dufour,	C.E.,	Mitchellsville, Md.
Edward Miall Durham, jr.,	C.E.,	Vicksburg, Miss.
Edward Hiram Dutcher, jr.,	M.E.,	South Meriden, Conn.
Timothy Sharpe Eden,	E.E.,	Brown's Town, Jamai-
George Ramsey Enscoe,	C.E.,	Bennett P. O. [ca.
William Alvin Evans,	E.M.,	Summit Hill.
Charles Victor Ferriday,	M.E.,	South Bethlehem.
*Charles Albert Andrew Fink,	M.E.,	Yonkers, N. Y.
Clarence Richard Fountain,	E.E.,	Good Hope, D. C.
Thomas Joseph Gannon,	M.E.,	South Bethlehem.
James Brown Given,	E.E.,	Carlisle.
*John Savage Graff,	E.E.,	Williamsport.
†William Heald Groverman,	M.E.,	Oakland, Md.

* Not clear of conditions.
† Excused.

	Course.	Residence.
David Hall,	E.E.,	Fayetteville, Tenn.
Harry N. Herr,	C.E.,	Wheatland Mills.
Howard Drysdale Hess,	M.E.,	Philadelphia.
*Oliver Zell Howard,	M.E.,	Hagerstown, Md.
Robert Parsons Howell,	C.E.,	Blairstown, N. J.
*William Thomas Hutchins,	C.E.,	Wyoming.
William Steell Jackson,	E.E.,	Duncannon.
*James Keys,	C.E.,	Conshohocken.
Victor Witmer Kline,	C.E.,	Lockport, N. Y.
*Robert Edwin Kresge,	A.C.,	South Bethlehem.
Robert Edward Laramy,	Clas.,	Bethlehem.
*Telford Lewis,	E.M.,	Blairsville.
*Sterling Catlin Lines,	E.E.,	Wilkes-Barre.
Bruce Emerson Loomis,	E.E.,	Wilkes-Barre.
Caleb Wheeler Lord,	M.E.,	Lebanon.
Clifford Sherron MacCalla,	E.E.,	Philadelphia.
James Gordon Mason,	E.M.,	West Pittston.
Victor Emanuel Masson,	A.C.,	Hammondsport, N. Y.
Edward Williamson Miller,	E.M.,	Bethlehem.
Elmer Wesley Mitchell,	C.E.,	Fall River, Mass.
Rafael de la Mora,	M.E.,	Guadalajara, Mex.
Charles Howard Morgan,	E.E.,	Maxatawny.
*William Hitz Mussey,	E.E.,	Washington, D. C.
John Henry Myers,	C.E.,	Lewistown.
John Buckley McBride,	C.E.,	Deckertown, N. J.
*Burt Melville McDonald,	C.E.,	Springfield, Mass.
Franklin Oberly,	E.E.,	Bethlehem.
Louis Atwell Olney,	A.C.,	Providence, R. I.
Horace Lucius Palmer,	C.E.,	Frenchtown, N. J.
*Harry Richards Peck,	M.E.,	Scranton.
*Jacob Grafius Petrikin,	Arch.,	Lock Haven.
*Morris Wright Pool,	M.E.,	Washington, D. C.
*Godwin Hall Powell,	E.M.,	Llanidloes, Wales.
James Lee Rankin, jr.,	M.E.,	Savannah, Ga.
Henry Paul Reed,	E.E.,	New London, Conn.
Homer Austin Reid,	C.E.,	Warren, O.

* Not clear of conditions.

	Course.	Residence.
†Antonio M. Ros-y-Jané,	M.E.,	Guantanamo, Cuba.
*George Homer Ruggles,	C.E.,	Cherokee, Iowa.
*John Cornelius Sesser,	C.E.,	Saint Joseph, Mich.
Arthur Yeager Shepherd,	M.E.,	Wilkes-Barre.
*Luther D. Showalter,	C.E.,	Pottstown.
Henry Shriver, jr.,	M.E.,	Cumberland, Md.
*Harvey Wilson Sprague,	M.E.,	Bethlehem.
Ambrose B. Strickler,	M.E.,	Waynesboro.
Edward Ernest Taylor,	M.E.,	Fort Wayne, Ind.
William Bailey Taylor,	E.E.,	Bethlehem.
John Augustus Thomson,	E.M.,	Summit Point, W.Va.
Edward Coppée Thurston,	E.M.,	South Bethlehem.
Joseph Wharton Thurston,	Clas.,	South Bethlehem.
Curtis Edward Trafton,	E.E.,	Fall River, Mass.
Harry Conklin Tripp,	M.E.,	Millerton, N. Y.
†Charles Parker Wagoner,	C.E.,	Phœnixville.
John Scofield Wallace,	E.M.,	New Castle.
U. Grant S. Walters,	C.E.,	Pottstown.
*John Eugene Weideman,	E.E.,	Washington, D. C.
William Gwilym Whildin,	E.M.,	Lansford.
Davis S. Williams,	Arch.,	Fort Snelling, Minn.
David William Wilson, jr.,	Arch.,	Brooklyn, N. Y.
*Jay Roberts Wilson,	E.E.,	Bethlehem.
Alfred Mahlon Worstall,	E.E.,	Millville, N. J.
*Frank S. Young,	E.M.,	Plymouth Meeting.

SOPHOMORE CLASS.

	Course.	Residence.
*Juan de Dios Amador,	E.E.,	Panama, Rep. Col.
Francis DuPont Ammen,	M.E.,	Ammendale, Md.
Henry Jonathan Biddle Baird,	E.M.,	West Chester.
Lathrop Hutchings Baldwin,	M.E.,	Allentown.
Charles Herbert Barker,	C.E.,	Morant Bay, Jamaica.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Charles Marshall Barton,	C.E.,	Pikesville, Md.
Frank Breckenridge Bell,	M.E.,	Mercer.
Harry Layfield Bell,	E.E.,	Norfolk, Va.
William Ragan Binkley,	E.E.,	Hagerstown, Md.
Francis Jos. Blickensderfer,	E.E.,	Bethlehem.
Bertine Frederick Borhek,	A.C.,	Bethlehem.
Charles Schwartze Bowers,	E.E.,	Philadelphia.
*Frank Austin Boyer,	E.M.,	Pine Grove.
John Boyt,	E.M.,	Adamsford.
William Burke Brady,	M.E.,	Harrisburg.
Daniel John Broughal,	A.C.,	South Bethlehem.
*Horatio Francis Brown,	M.E.,	Baltimore, Md.
Walter Everette Brown,	E.E.,	Stamford, Conn.
*Robert Berdell Cable, jr.,	M.E.,	Bethlehem.
*David J. Castilla,	M.E.,	Coahuila, Mex.
*Amado Cavazos,	E.M.,	Saltillo, Mex.
Sinclair Wiggins Chiles,	C.E.,	Sims City, Fla.
Thomas Holland Clagett,	E.M.,	Berryville, Va.
*Thomas Micks Clinton,	E.E.,	Baltimore, Md.
Barton Olmsted Curtis,	C.E.,	Iowa City, Iowa.
*Patrick Edward Dinan,	A.C.,	South Bethlehem.
Louis Diven,	E.E.,	Elmira, N. Y.
William Kuhn Dunbar,	C.E.,	Pittsburg.
*Clifford George Dunnells,	E.E.,	Pittsburg.
Stuart Rhett Elliott,	E.M.,	Beaufort, S. C.
*John Augustus Fisher,	E.M.,	Huntingdon.
Ira D. Fulmer,	E.E.,	Richland Centre.
Francis Martinez Gallardo,	M.E.,	Guadalajara, Mex.
Orrin Satterlee Good,	E.E.,	Lock Haven.
Ralph Scofield Griswold,	E.E.,	Madison, N. J.
John Lewis Gross,	M.E.,	Wilkes-Barre.
†Frank Hammond Gunsolus,	Arch.,	Tipton, Iowa.
Hugh Ellmaker Hale,	C.E.,	Philipsburg.
*Charles Edwin Hammond,	C.E.,	Geneva, N. Y.
William Thomas Hanly,	C.E.,	Philadelphia.
Erle Reiter Hannum,	E.E.,	Pottsville.

* Not clear of conditions.

	Course.	Residence.
Albert Wilfred Harned,	M.E.,	Philadelphia.
William Stephen Hiester,	E.E.,	Elmira, N. Y.
Ross Nathaniel Hood,	E.E.,	Duncannon.
Henry Taylor Irwin,	M.E.,	Allegheny.
James Madison Jackson,	M.E.,	Parkersburg, W. Va.
*Philip H. Janney,	M.E.,	Baltimore, Md.
Arthur Perkins Jenks,	E.E.,	Philadelphia.
Harry Sackett Johnson,	E.E.,	East Aurora, N. Y.
Duncan Kennedy, jr.,	E.E.,	Newport, R. I.
Lawrence Rust Lee,	M.E.,	Shepherdstown, W.Va
Ernest Tisdel Lefevre,	E.M.,	Panama, Rep. Col.
†Charles Victor Livingstone,	E.E.,	Kingston, N. Y.
Arthur Frost Loomis,	E.E.,	Oneida, N. Y.
Owen Gray MacKnight,	E.E.,	Plains.
Barry MacNutt,	E.E.,	Bethlehem.
*Lee Holmes Marshall,	M.E.,	Pittsburg.
William A. Megraw,	M.E.,	Baltimore, Md.
*Esteban Angel Mercenario,	C.E.,	Puebla, Mex.
Thaddeus Merriman,	C.E.,	South Bethlehem.
Frank Douglass Mount,	C.E.,	Manasquan, N. J.
Carl Pivany Nachod,	E.E.,	Philadelphia.
*Charles G. Newton,	E.M.,	Guadalajara, Mexico.
*Henry H. Newton,	M.E.,	Guadalajara, Mexico.
Robert Collyer Noerr,	C.E.,	Washington, D. C.
Charles Carroll O'Donnell,	C.E.,	Connellsville.
John O'Reilly,	A.C.,	Philadelphia.
James Harkins Pennington,	M.E.,	Yerkes.
William Lindley Pettit, jr.,	C.E.,	Fort Wayne, Ind.
†Edward Arlington Pittis,	C.E.,	Washington, D. C.
*Samuel Jackson Randall,	Sci.,	South Bethlehem.
John Peake Reynolds, jr.,	M.E.,	Charleston, S. C.
Samuel Stewart Riegel,	M.E.,	South Bethlehem.
Eugene P. Roundey,	C.E.,	East Orange, N. J.
Woodford Royce,	M.E.,	Willimantic, Conn.
Auguste Leopold Saltzman,	M.E.,	Plainfield, N. J.
*Charles Fred. Sanders,	C.E.,	Kutztown.

* Not clear of conditions.
† Excused.

	Course.	Residence.
*Charles Francis Scott,	E.E.,	New York City.
Henry Hamilton Seabrook,	E.E.,	Beaufort, S. C.
Joseph Israel Seigfried,	A.C.,	South Bethlehem.
Samuel Palmer Senior,	C.E.,	Washington, D. C.
Arthur Harold Serrell,	E.E.,	Plainfield, N. J.
Frank Bradley Sheaffer,	C.E.,	New Bethlehem.
John Leefe Sheppard, jr.,	M.E.,	Charleston, S. C.
Edward Peter Shuman,	C.E.,	Allentown.
Joseph Henry Siegel,	E.M.,	Salt Lake City, Utah.
Jonathan Edward Slade,	C.E.,	Chicago, Ill.
*Michael T. Eagan Stack,	C.E.,	Shenandoah.
Alvin Riegel Sterner,	E.E.,	Bethlehem.
John Stewart, jr.,	E.M.,	Lonaconing, Md.
Paul Beno Straub,	E.E.,	Pittsburg.
*John Williams Thomas,	E.E.,	Hokendauqua.
Thomas Cedwyn Thomas,	E.M.,	Wilkes-Barre.
Columbus William Thorn,	C.E.,	Washington, D. C.
William Tidball,	E.E.,	New York City.
Wallace Treichler,	C.E.,	Elizabethtown.
Harry Carpenter Tschudy,	C.E.,	Smyrna, Del.
William Edward Underwood,	M.E.,	Lancaster.
Harrison Ricord Van Duyne,	E.E.,	Newark, N. J.
*James F. Wallace,	A.C.,	New Castle.
Edward Hileman Waring,	M.E.,	Plainfield, N. J.
*Clarence Earl Weaver,	E.E.,	Bradford.
Gilbert Case White,	C.E.,	Richmond, Va.
I. H. Wiesenberg,	A.C.,	South Bethlehem.
*William Bell Wood,	M.E.,	Baltimore, Md.
Warren Worthington,	E.E.,	Rush Valley.
George Livingston Yates,	E.E.,	Carlisle.
Ambrose Everett Yohn,	M.E.,	Saxton.

* Not clear of conditions.

FRESHMAN CLASS.

	Course.	Residence.
Harry Leigh Adams,	C.E.,	Washington, D. C.
†Llewellyn Allport,	C.E.,	Philipsburg.
Thomas Johns Anderson,	M.E.,	Cumberland, Md.
William Ernst Arrison,	E.E.,	Philadelphia.
Alanson Quigley Bailey,	Clas.,	Paterson, N. J.
*Clarence Barnard,	E.E.,	Washington, D. C.
*Alejandro Barrientos,	C.E.,	Santiago de Cuba.
Carlos Hernaiz Becerra,	E.M.,	Bogota, Rep. Col.
Richard Becerra, jr.,	A.C.,	Bogota, Rep. Col.
Arthur K. Birch,	E.E.,	Washington, D. C.
Henry David Bishop,	M.E.,	Bethlehem.
Henry Theodore Borhek,	E.M.,	Bethlehem.
Ralph Raymond Bowdle,	C.E.,	Bethlehem.
Paul Bucher,	E.E.,	Lebanon.
*Mahlon Brown Buckman,	E.E.,	Philadelphia.
John W. Burrows,	E.E.,	Sewickley.
Robert William Canning,	E.E.,	South Bethlehem.
†Greenleaf Howe Chasmar,	E.E.,	Brooklyn, N. Y.
David Hope Childs,	E.M.,	Towanda.
Richard Francis Cleary,	E.E.,	Mahanoy City.
Benjamin Cooper Corbett,	M.E.,	New York City.
Herbert Myron Daggett,	E.E.,	Elmira, N. Y.
*Frank Foster Daves,	M.E.,	Baltimore, Md.
William Adam Dehm,	C.E.,	New Britain, Conn.
Willis Edward Diehl,	C.E.,	Bethlehem.
*Neale Edward Donnellon,	A.C.,	Brooklyn, N. Y.
*Lewis Rutter Downing,	C.E.,	East Downingtown.
John Jacob Eckfeldt,	M.E.,	Conshohocken.
Linden Erle Edgar,	M.E.,	Wilkes-Barre.
Edgar D. Edmonston,	E.E.,	Washington, D. C.
James Chickering England,	E.E.,	Washington, N. J.
Roy Lyman Evans,	C.E.,	Bethlehem.
James Ralph Farwell,	M.E.,	Oswego, N. Y.
*Herbert William Fitzgerald,	E.E.,	Columbia.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Theodore Frederick Forbes,	E.E.,	St. Augustine, Fla.
Grier Foresman,	A.C.,	Williamsport.
*Peirce Currier Foster,	E.E.,	Washington, D. C.
*Edmund William Fothergill,	M.E.,	Fall River, Mass.
Willard Boyer Fuller,	M.E.,	Catasauqua.
†Archibald S. Furtwangler,	E.M.,	Greensburg.
José Maria Garza Galan,	E.M.,	Saltillo, Mex.
J. Walter Gannon,	C.E.,	New Brighton, N. Y.
Manuel Garcia,	E.E.,	Porto Rico.
*Stuart John Gass,	E.E.,	Washington, D. C.
Robert Edward Lee George,	E.E.,	Ellicott City, Md.
Charles Gore,	E.M.,	St. George, Md.
William Gratz,	E.E.,	Carmel, N. J.
William Gummere,	A.C.,	South Bethlehem.
Wentworth Greene Hare,	M.E.,	Philadelphia.
Bolling Haxall Harrison,	E.M.,	Baltimore, Md.
*John Dwight Hastings,	E.E.,	Christiana.
Raymond Hazel,	E.E.,	Cressona.
†George Duncan Heisey,	E.M.,	Pittsburg.
Henry Bruner Hershey,	E.E.,	Columbia.
Herbert H. Hess,	E.E.,	Hellertown.
Edward D. Hillman,	M.E.,	Wilkes-Barre.
Harold John Horn,	E.E.,	South Bethlehem.
Leonard S. Horner,	E.E.,	Marshall, Va.
James Cuthbert Holderness,	E.E.,	Cambridge, Mass.
Harry Reese James,	M.E.,	Braddock.
Spencer Jackson Johnson,	E.M.,	Chicago, Ill.
Edwin H. Kiehl,	C.E.,	Lancaster.
Wilmot Henry Kissam,	C.E.,	Huntington, N. Y.
Frank Norman Kneas,	C.E.,	Norristown.
Arthur Octavius Knight,	E.E.,	Washington, D. C.
†Edward Steckel Knisely,	M.E.,	Bethlehem.
Basil George Kodjbanoff,	E.E.,	Monastir, Macedonia.
Lewis Daniel Kreidler,	A.C.,	Bath.
*L. H. Kunkle,	M.E.,	Greensburg.
Thomas H. Lawrence,	E.E.,	Danville.

* Not clear of conditions.
† Excused.

	Course.	Residence.
George Craig Leidy,	E.E.,	Washington, D. C.
Newton Wambold Leidy,	E.E.,	West Bethlehem.
Joseph William Linton,	E.E.,	Bethlehem.
Clarence Albert Loomis,	C.E.,	Bethlehem.
Ralston Rife Lukens,	C.E.,	Atglen.
Frederic Kennedy Lundy,	E.E.,	Williamsport.
Robert Lazarus Martz,	Arch.,	Allentown.
George Beaver Mauser,	A.C.,	Treichlers.
C. Lyman Meixel,	E.E.,	Hummelstown.
Sidney Burbank Merrill,	A.C.,	Newport, Ky.
Erwin Preston Miller,	L.S.,	Bethlehem.
Charles Francis Moritz,	E.E.,	South Bethlehem.
Frank Jacob Myers,	E.M.,	Bethlehem.
George K. McGunnegle,	A.C.,	Meadville.
Marion Arminius Nagle,	M.E.,	Elmira, N. Y.
Edward Jay Newbaker,	E.M.,	Danville.
José Aristides de Obaldia,	C.E.,	Panama, Rep. Col.
Howard Charles Paddock,	C.E.,	East Berlin, Conn.
Henry Ralph Palmer,	E.E.,	West Chester.
Frederick Allen Perley,	C.E.,	Williamsport.
Clarence Marion Pflueger,	A.C.,	Seidersville.
*Victor Clinton Records,	C.E.,	Laurel, Del.
Percy Lawrence Reed,	C.E.,	New Bedford, Mass.
Benjamin DeWitt Riegel,	M.E.,	Riegelsville, N. J.
Howard Albert Riegel,	C.E.,	Bethlehem.
George Milton Robinson, jr.,	E.E.,	Elmira, N. Y.
Carl John Roelker,	E.E.,	Washington, D. C.
D'Arcy Wentworth Roper,	M.E.,	Petersburg, Va.
Wallace Edgar Ruhe,	E.E.,	Allentown.
Rafael Francisco Sanchez,	E.M.,	Matanzas, Cuba.
*Arthur Percy de Saulles,	M.E.,	South Bethlehem.
Frank Ezekiel Schneller,	A.C.,	Bethlehem.
Henry Harger Scovil,	M.E.,	Copenhagen, N. Y.
Frank H. Shenck,	M.E.,	Salunga.
Daniel Franklin B. Shepp,	C.E.,	Tamaqua.
Louis Soleliac, jr.,	E.E.,	Allentown.

* Not clear of conditions.

	Course.	Residence.
Lewis Cheston Starkey,	M.E.,	Bustleton.
James Willis Stauffer,	Arch.,	South Bethlehem.
Robert Witmer Sterrett,	E.E.,	Milroy.
Martin S. Stockett,	Clas.,	Pottsville.
Edmund Harrison Symington,	M.E.,	Baltimore, Md.
John Tenney, jr.,	C.E.,	Philadelphia.
Harry Wellington Thatcher,	A.C.,	South Bethlehem.
William Wharton Thurston,	E.M.,	South Bethlehem.
Richard Albert Turner,	C.E.,	Willimantic, Conn.
William F. Ulrich,	A.C.,	Bethlehem.
*Laurens Van Benthem van den Bergh,	E.E.,	Arnhem, Holland.
Charles Bartlett Warren,	M.E.,	Westfield, Mass.
Levi Watts,	E.E.,	Terre Hill.
Charles Edward Webster, jr.,	Clas.,	South Bethlehem.
David Sheibley Wert,	E.E.,	Carlisle.
Frederick Charles Wettlaufer,	A.C.,	Hoboken, N. J.
Howard Josephus Wiegner,	Arch.,	Bethlehem.
Harry Packer Wilbur,	A.C.,	South Bethlehem.
Theodore Benjamin Wood, jr.,	M.E.,	Chambersburg.
Lawrence Wooden,	A.C.,	Hampstead, Md.
Samuel A. Yorks,	E.E.,	Danville.
Harry Statten Zimmerman,	C.E.,	State Line.

SPECIAL STUDENTS.

	Course.	Residence.
Chauncey Matlock,	E.E.,	Brooklyn, N. Y.
Gwynne Harris Sharrer,	E.M.,	Washington, D. C.
Frank Betts Smith,	M.E.,	Hartford, Conn.
Ignacio Maria Zertuche,	E.M.,	Matehuala, Mex.

* Not clear of conditions.

SUMMARY OF STUDENTS BY STATES.

Vermont,	1
Massachusetts,	8
Rhode Island,	4
Connecticut,	11
New York,	37
New Jersey,	27
Pennsylvania,	263
Delaware,	4
Maryland,	35
District of Columbia,	25
Virginia,	8
West Virginia,	4
North Carolina,	1
South Carolina,	5
Georgia,	2
Florida,	2
Mississippi,	2
Kentucky,	3
Tennessee,	3
Missouri,	2
Ohio,	3
Indiana,	3
Illinois,	5
Michigan,	1
Minnesota,	3
Iowa,	4

Kansas,	1
Utah,	1
Indian Territory,	2
Nova Scotia,	1
Mexico,	10
Cuba,	4
Jamaica,	3
Porto Rico,	1
Costa Rica,	1
Republic of Colombia,	5
Wales,	1
Holland,	2
Macedonia,	1
	499

SUMMARY OF STUDENTS BY CLASSES AND COURSES.

	Graduates.	Seniors.	Juniors.	Sophomores.	Freshmen.	Specials.	Totals.
Classical,	4	6	3	—	3	—	16
Latin-Scientific,	—	1	—	—	1	—	2
Science and Letters,	—	4	1	1	—	—	6
Civil Engineering,	3	40	35	26	24	—	128
Mechanical Eng.,	2	20	25	27	24	1	99
Mining Eng.,	6	14	11	12	13	2	58
Electrical Eng.,	2	27	27	33	46	1	136
Analytical Chem.,	3	12	5	7	14	—	41
Architecture,	1	3	5	1	3	—	13
Totals,	21	127	112	107	128	4	499

THE LEHIGH UNIVERSITY.

ORIGIN.

The Hon. Asa Packer, of Mauch Chunk, during the year 1865, appropriated the sum of $500,000, to which he added one hundred and fifteen acres of land in South Bethlehem, to establish an educational institution in the rich and beautiful Valley of the Lehigh. From this foundation rose The Lehigh University, incorporated by the Legislature of Pennsylvania in 1866. In addition to these gifts, made during his lifetime, Judge Packer by his last will secured to the University an endowment of $1,500,000, and to the University Library one of $500,000.

DESIGN.

The original object of Judge Packer was to afford the young men of the Lehigh Valley a complete education, technical, literary, and scientific, for those professions represented in the development of the peculiar resources of the surrounding region. In furtherance of this purpose instruction is liberally provided in Civil, Mechanical, Mining, and Electrical Engineering, Chemistry, Metallurgy, Architecture, and in all needful collateral studies. A School of General Literature is also established and thoroughly equipped, with three departments, called respectively the Classical, the Latin-Scientific, and that of Science and Letters. These departments are kept up to the standard, and the requirements for entrance are the same as those of our best Classical and Literary institutions.

TUITION.

The following charges are made for tuition:

For students in the Technical courses, $100 per annum: $40 for the first term, $60 for the second term; for stu-

dents in the school of General Literature, $60 per annum: $25 for the first term, $35 for the second term.

These fees include all tuition, with the use of the Library and Gymnasium, but the student is charged for materials and apparatus consumed in the Laboratories.

The Trustees have placed at the disposal of the Faculty a limited number of scholarships, to be awarded to applicants of good moral character who shall pass the entrance examinations creditably, and who for other cause shall be regarded as worthy by the Faculty.

Applications for these free scholarships should be made, not less than one week before the opening of the term, to the President of the University, who will furnish all needed information concerning the regulations which govern their bestowal.

All fees for tuition are payable to the Treasurer of the University in two instalments, as above. The first instalment is to be paid to the treasurer of the University on or before October 10; the second on or before January 20.

Students who fail to pay tuition fees when due will be notified by the President that their attendance at college exercises must be discontinued until payment is made.

Every candidate for a degree is required to pay a graduation fee of $10, when the degree is awarded.

PUBLIC WORSHIP.

Prayers are held in the Packer Memorial Church of the University every morning and all students are required to be present.

Divine service is held every Sunday morning in the church. The service is according to the forms of the Protestant Episcopal Church, under whose auspices the University was placed by its Founder. Attendance is required of every student, except in case of those connected with other religious bodies, to whom the President will grant permission at the beginning of each term (if requested

by the parent or guardian, or by the student himself if he be 21 years of age) to attend during that term the place of worship of the body with which he is connected, where attendance on Sunday morning will be required.

SITE.

The situation of the institution is healthful and beautiful. The region is famous for its railway and manufacturing enterprises; it possesses some of the richest iron and coal mines in our land, and thus gives the students rare facilities for confirming the teachings of the recitation room by the observation of the eye.

The University buildings are about a half-mile from the depot, at the junction of the Lehigh Valley and North Pennsylvania Railroads. New York is ninety-two and Philadelphia fifty-seven miles distant.

BUILDINGS.

PACKER HALL,

named after the Founder, stands seven hundred feet back of Packer Avenue, at the base of the South Mountain. It is built of stone, and contains lecture and recitation rooms, the drawing rooms, and the museum of geology and natural history.

THE CHEMICAL LABORATORY

is thoroughly fire-proof, is built of sandstone, and is 219 feet in length by 44 in width.

There are two principal stories and a basement. The upper floor is occupied by the quantitative and the qualitative chemical laboratories, the former accommodating 48 and the latter 84 students. These rooms are 22 feet in height, and are well lighted and ventilated. A laboratory for industrial chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a recitation room, a chemical museum, and laboratories for organic, physiological, agricultural, and sanitary chemistry.

In the basement is the large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis, also rooms containing the apparatus for several processes in industrial chemistry, the engine and air-pump for vacuum filtration, a store room, and the toilet.

A photographic laboratory is located in the third story of the central portion of the building.

THE METALLURGICAL LABORATORY

contains a lecture room, a blowpipe laboratory for class instruction in blowpipe analysis and in the practical determination of crystals and minerals, a museum for mineralogical and metallurgical collections, a mineralogical laboratory provided with a Fuess reflecting goniometer, a polariscope, a Groth's "universal apparat," and a Rosenbusch polarizing microscope, a dry laboratory provided with furnaces for solid fuel and for gas with natural draught and with blast, and a wet laboratory for ordinary analytical work. It is arranged for the instruction of classes in the courses of mineralogy, metallurgy, and blowpipe analysis of the regular curriculum, and to afford facilities to a limited number of advanced students for familiarizing themselves with the methods of measurement and research employed in mineralogy and metallurgy, and for conducting original investigations in these departments of science.

THE NEW PHYSICAL LABORATORY.

This building has been finished and is now in use. It is of stone, 235 feet in length, and 4 stories in height. The first or ground floor is devoted to electrical work, and forms the Senior Electrical Laboratory. It contains a large dynamo room, with the engine, dynamos, and motors, with all their appliances; battery, balance, calorimetric rooms and workshops. The eastern part of this story has been carefully arranged for delicate work. The use of iron has been avoided; the gas and steam mains and pipes, radiators, etc., are all of brass. In this section are seven special rooms for investigations of the magnetic properties of iron and

original research. A hall over 200 feet in length can be darkened and utilized for long range work in testing lamps. Under this floor is the "cave" or even-temperature room, completely enclosed with solid stone masonry. On this and the other three floors are private laboratories, store and apparatus rooms, and offices for instructors.

The second story contains the Junior Electrical Laboratory, 56 by 44 feet; the Mechanical Laboratory, 60 by 44 feet, with tables for 80 students, the Library, a time and two balance rooms, with floors resting on solid stone arches.

On the third floor is a public hall, 70 by 44 feet, for examinations; also the professor's lecture room, 40 by 44 feet, with private laboratories, etc.

On the fourth floor in the west wing are two recitation rooms for the instructors, 40 by 18 feet, and the Heat Laboratory, 44 feet square, with tables for 72 persons. On the east side is the Light Laboratory. This contains one room with tables for 40 persons, and 8 smaller dark rooms, each of which can be divided into two parts. Besides these are 4 photographic dark rooms, 8 by 28 feet feet, each with all the necessary equipments.

The tower, which is devoted to meteorological purposes, has two stories of one room each, 16 by 21 feet, with a vane room above. Besides these there are several small rooms for special purposes scattered among the four floors.

The tendency in the latest and best Physical Laboratories is towards a larger number of smaller rooms, rather than to a few large rooms. It will be seen from this description that the advantages of this plan have been gained by the many smaller rooms that exist, while for general work the larger halls are provided.

Three staircases at the middle and the two ends of the building afford ample means of entrance and egress.

THE SAYRE OBSERVATORY.

Near Brodhead Avenue is the Sayre Observatory, the gift of Robert H. Sayre, Esq., of South Bethlehem, containing an equatorial and a zenith telescope, transit instrument, and astronomical clock.

THE PACKER MEMORIAL CHURCH

is the munificent gift of Mrs. Mary Packer Cummings, daughter of the Founder of the University. It is a large and magnificent Church, richly furnished and handsomely appointed in every particular. There is no more beautiful Church edifice in the State and it is one of the noblest in all the land.

THE UNIVERSITY LIBRARY.

To the east of Packer Hall is the University Library, erected by the Founder in memory of Mrs. Lucy Packer Linderman, his daughter.

THE GYMNASIUM

is a handsome and spacious structure, built and equipped with the utmost thoroughness. It is furnished with the best patterns of gymnastic apparatus, besides Dr. Sargent's system of developing appliances. It is provided with hot and cold water; tub, sponge, and shower baths, and 389 clothes closets. Opportunities for recreation and amusement are provided in the bowling alleys. It is under the immediate care of a skilled and competent Director.

All students are required to undergo a physical examination before being allowed the use of the Gymnasium, and this examination will be repeated once each year during their stay at the University. The proper exercise is prescribed and is required of every student. These regulations are designed to promote the harmonious, symmetrical development of the individual student.

EXPENSES.

Books, materials, paper, pencils, materials used in the chemical laboratories, and drawing instruments are furnished by the student. Materials consumed in the chemical laboratories can be obtained from the University, their value being covered by a deposit made at the opening of that term in which the laboratory work is to be done.

Rooms and board can not be had in University buildings, but can readily be obtained in many private houses.

The following is an estimate of the necessary expenses for the collegiate year, clothing and traveling not included :

Tuition, ...		$100	$100
Board for 40 weeks, . . .	from	160 to	200
Room-rent, with fuel and lights .		40 "	80
Care of room and use of furniture, .		5 "	20
Washing and incidentals, ...		20 "	40
Books, stationery, etc., . . .		25 "	50
Total, ...		$350 to	$490

(In the case of students in the School of General Literature, the totals will be $310 to $450.)

NOTE.—If clubs be formed the cost of board need not exceed $3.50 per week.

ADMISSION OF STUDENTS.

The Register is intended to give all necessary information concerning the admission of students. Application may be made to the President of the University if information is desired which is not given in the Register.

DATE OF EXAMINATIONS

Examinations for admission to the University are held at the opening of each term, and also in June at the close of the academic year.

The examinations for 1895 will be on Tuesday and Wednesday, January 8 and 9, for admission to the second term; on Thursday, Friday, and Saturday, June 20, 21, and 22, and on Saturday, Monday, and Tuesday, September 7, 9, and 10, for admission to the first term. No other examinations for entrance will be held, except for good cause, and all applicants *must* be in attendance at 9 o'clock on the morning of the first day.

The examinations are held in June and September in the following order:

First Day.—English, 9 A.M.; Arithmetic, 11 A.M.; Physics, 2 P.M.; Latin and Roman History, 2 P.M.

Second Day.—Geometry, 8.30 A.M.; Physical Geography, 11.30 A.M.; Geography, 3 P.M.; United States History, 4 P.M.

Third Day.—Algebra, 8.30 A.M.; Greek and Greek History, 2 P.M.

Applicants for entrance who wish to present certificates from preparatory schools as an equivalent for the examinations in English, Geography, and U. S. History are required to hand them to the examiner at 8.15 on the morning of the first day.

The schedules of examinations for applicants for admission to the Freshman Class at the beginning of the second term and to the Sophomore Class at the beginning of the first term may be obtained from the Secretary of the Faculty. Examinations at other than the appointed times can not be granted without great inconvenience, and candidates so applying will be required to pay a fee of $5 into the Faculty's fund for the aid of indigent students.

CHARACTER OF THE EXAMINATIONS.

The examinations are rigorous and cover the entire ground laid down in the following scheme. They are all conducted in writing, supplemented by an oral examination at the option of the examiner.

Each candidate for admission must be at least sixteen years of age, and must present a testimonial of good moral character from his last instructor, or from the school or institute to which he last belonged, or from some reputable citizen of the community in which he lives.

Candidates for admission to

THE CLASSICAL COURSE

are examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition. Candidates are required to write a composition of four hundred words upon a subject announced at the time. The subject in 1895 will be taken from one of the following works: Longfellow's Evangeline, Scott's Kenilworth, Dickens's Nicholas Nickleby, Gray's Elegy in a Country Churchyard. In 1896, a subject will be taken from one of the following: Scott's Lady of the Lake, Dickens's David Copperfield, Irving's Sketch Book, Hawthorne's Marble Faun.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution.*

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures.

[Chauvenet's Geometry (four books) is recommended, that being the text-book used in the University.]

7. *Physical Geography.*

8. *Latin Grammar.*

9. *Cæsar*, four books of the Gallic war.

10. *Cicero*, six orations, including the four against Catiline.

11. *Vergil*, the first six books of the Æneid, including Prosody.

12. The translation, at sight, of passages from Cæsar and Cicero.

13. The translation of English into Latin. (As special importance is given this part of the examination, it is suggested to teachers that they connect exercises in making Latin, both oral and written, with all the studies of the preparatory course.)

14. *Roman History.*—Creighton, Pennell, or Myers.

15. *Greek Grammar.*

16. *Xenophon*, Anabasis, four books.

17. *Homer*, Iliad, first three books, including Prosody The Catalogue of Ships may be omitted.

18. The translation, at sight, of a passage from some work of Xenophon.

19. *Greek History.*—Fyffe, Pennell, or Myers (pp. 152–357).

20. Writing Greek with accents.

The pronunciation of Greek according to the written accents is followed in the University, and it is desirable that students preparing to enter be taught this system.

Latin is pronounced according to the method generally known as the Roman Method.

THE LATIN-SCIENTIFIC COURSE.

Candidates for admission to this course must present the first fourteen of the above requirements, but substitute for the Greek sections (numbers 15–20 inclusive) the following:

21. *Geometry.*—Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles: these constituting the subject matter of Books Five and Six of Chauvenet's Geometry.

THE COURSE IN SCIENCE AND LETTERS.

Candidates for admission to this course are examined in all the subjects demanded of those entering the Latin-Scientific Course, except the Latin and Physical Geography sections (numbers 7–14 inclusive). They also present the following:

22. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; also Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory by the student and the calculation of problems arising in the work.]

THE SCHOOL OF TECHNOLOGY.

Candidates for admission to the Courses in Civil Engineering, Mechanical Engineering, Mining Engineering, Electrical Engineering, Chemistry, and Architecture are examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition. Candidates are required to write a composition of four hundred words upon a subject to be announced at the time. The subject in 1895 will be taken from one of the following works: Longfellow's Evangeline, Scott's Kenilworth, Dickens's Nicholas Nickleby, Gray's Elegy in a Country Churchyard. In 1896 a subject will be taken from one of the following: Scott's Lady of the Lake, Dickens's David Copperfield, Irving's Sketch-Book, Hawthorne's Marble Faun. It is recommended that candidates have a knowledge of Latin Grammar, although an examination in it is not required for any courses except the Classical and the Latin-Scientific.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution.*

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures. Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles; these constituting the subject matter of the first six books of Chauvenet's Geometry.

[Chauvenet's Geometry is recommended, that being the text-book used in the University.]

7. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; also Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory and the calculation of problems arising in the work.]

Division of Entrance Examination.

Candidates for admission to the Freshman Class may pass all the examinations in June, or all in September, or partly in June and partly in September, or may take them in *two consecutive years.* In the latter case, for the Technical courses and the course in Science and Letters, candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, and Arithmetic. No credit will be given unless the candidate has passed satisfactorily in at least three subjects at one examination.

The examinations in Algebra, Geometry, and Physics must be passed in June or September of that year in which the candidate proposes to enter the University.

In the Latin-Scientific and Classical courses candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, Arithmetic, Physical Geography, Roman History, and Greek History. No credit will be given unless the candidate has passed at least four of the subjects at one examination.

The examination in Latin may also be divided, but no credit will be given unless the candidate has passed in at least three of the topics specified at one examination. The examinations in the remaining subjects must be passed in June or September of that year in which the candidate proposes to enter the University.

Candidates intending to enter the University in September are advised to present themselves for examination in June; if they are not fully prepared at that time they will receive credit for the examinations then satisfactorily passed.

CONDITIONAL ADMISSION.

A candidate failing to pass in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to his class conditionally, to make up his deficiencies by extra study. When they are made up, he will be received into full standing in his class.

SPECIAL STUDENTS.

Young men of advanced standing, who do not desire to take a full regular course, can enter and select special shorter courses, with the sanction of the Faculty; but in all cases satisfactory examinations must be passed upon the subjects required for entrance to the Freshman Class.

ADMISSION TO ADVANCED STUDIES.

Candidates for admission to advanced studies *in any course* are required to pass, *in addition to the entrance examinations for that course*, examinations in the work already done by the classes which they desire to enter. These examinations are held on the same days as those for entrance to the Freshman Class.

The additional subjects may be found in the program of studies.

A diploma showing that a degree has been conferred, or a certificate of studies taken at another College will be received, in so far as it covers the subjects required for entrance, in lieu of the *Primary Entrance Examinations only.*

ADMISSION TO THE POST-GRADUATE COURSE.

Students of this University who have taken their *first* degree, and others, on presenting a diploma of an equivalent degree conferred elsewhere, are admitted to advanced studies, according to the plan to be found in the Register under the general subject of Graduate Students.

PREPARATORY SCHOOL CERTIFICATES

are not accepted so as to dispense with the primary entrance examinations.

NOTE.—The acceptance of a certificate as evidence of proficiency in lieu of examination is at the discretion of each Professor as to the subjects in his department.

PROGRAM OF STUDIES.

Showing the number of exercises per week for each subject, and the Text-books used.

The following is presented as the general program of instruction, subject to such modifications from time to time as the Faculty may deem expedient, with the approval of the Trustees.

The names of the text-books studied are generally mentioned. The number of exercises per week in each subject is indicated by the figure in parenthesis immediately following.

Two hours of drawing, three of work in the laboratory, or three of practice in the field, are regarded as equivalent to a recitation or lecture of one hour's duration.

SCHOOL OF GENERAL LITERATURE.

There are three courses in the School of General Literature of the University.

I. The Classical Course includes all that is prescribed in our best institutions for the degree of Bachelor of Arts (B.A.). It covers full instruction in Greek, Latin, English, French and German, Mathematics, Astronomy, Physics, Chemistry, Geology, Physiology, Hygiene, History, Psychology, Ethics, Philosophy, Political Economy, and Constitutional Law.

II. The Latin-Scientific Course differs from the first in omitting Greek, taking in its place an increased amount of the Modern Languages and of Mathematics. Students completing this course receive the degree of Bachelor of Science (B.S.).

III. The Course in Science and Letters, for which the same degree is given as for the last mentioned, contains no Latin or Greek, but furnishes instead extended instruction in French and German, History, General Literature, Mathematics, and General Science.

Instruction in all of these courses is given both by recitations and by lectures.

DESCRIPTION OF THE COURSES.

GREEK.—During the first term of Freshman year the class reads several books of the Odyssey, giving attention to epic forms and syntax, to prosody and scanning, and to Homeric antiquities and mythology. The work of the second term is directed toward a thorough acquaintance with the idiom and vocabulary of Attic prose, as a preparation for rapid reading. The Œconomicus and Symposium of Xenophon and the Crito of Plato are read during the term, with sight readings from the Memorabilia and the Apology; accompanied with discussions of domestic life at Athens. The work of the year includes a thorough review-drill on the principles of Greek accidence and syntax, and exercises in Greek prose composition are required, based, during the second term, on the reading done by the class. Greek history is studied throughout the year, with special reference to the development of political institutions.

The Sophomore class takes up, during the first term, the study of Herodotus and Thucydides. Selections are made from both authors with the purpose of illustrating their best style and at the same time of presenting, from the original sources, the history of certain interesting epochs; the reading from Herodotus, after some drill on the Ionic forms, being in large part at sight. During the second term the class reads one or two plays of Euripides, with attention to the history of Greek tragedy, the life of the author, and the analysis of the drama read. The lyric meters are studied, with the aim of gaining a knowledge

of the rhythmical and metrical principles of Greek poetry. During this term an elective course is offered, the subject being Greek oratory, with the reading of certain orations of Lysias or Demosthenes, or both.

The Junior year is devoted to a further study of the drama, selected plays of Sophocles, Aristophanes, and Æschylus being read during the year. Work is also done in the study of public and private antiquities, partly in lectures by the professor and partly in original investigation on allotted subjects by the students.

During the first term of the Senior year the class reads either selections from Thucydides, or one of the dialogues of Plato. The second term is in part devoted to the reading of selected odes of Pindar, with careful study of the history of Greek lyric poetry and of the life and work of Pindar in particular. The course concludes with a review of the history of Greek literature, intended to summarize and harmonize the fragmentary views of the general subject gained from the study of particular authors and departments of literature.

LATIN.—Much of the training in the Freshman year is devoted to laying a good foundation in Latin grammar and in the translation of English into Latin. The authors studied are used to illustrate both of these, and a large amount is read at sight in order to cultivate quickness and readiness in the student. Roman history is begun, accompanied with full comments and lectures upon points of interest. Collateral reading will also be recommended each year throughout the course. Cicero: De Senectute and De Amicitia or the Philippics, Livy, and the Odes and Epodes or Horace are read this year. With the last named, training is given in Latin meters.

During this and the following year courses of lectures will be given upon Roman antiquities in addition to a textbook. The topography of Rome with its remains, ancient life in its various aspects, and the other departments of archæology will be discussed, illustrated by the new and

extensive set of over 3600 magic lantern slides which have been prepared for this purpose.

The Sophomore year completes the text-book on Roman history. Quintilian (Bk. X) with Crowell's Selections from the Lyric Poets will be read in the first term, and in the second the Agricola and Germania, with selections from the Annals of Tacitus, together with sight reading.

In the Junior year, selected letters of Cicero and Pliny are read, followed by Persius and several plays of Terence and Plautus. The history of Roman literature is entered upon in the second term.

The work in the Senior year opens with Lucretius, accompanied with lectures on Roman philosophy. The course in the second term this year includes the study of ancient Latin, using Allen's Remnants of Early Latin, supplemented by a series of lectures upon Latin grammar and the history of the development of the language, together with several lectures upon the history of classical philology. Characteristic poems by various authors will be read with full comment and training in the discussion of the literary and critical points which come up.

SANSKRIT.—An elementary course in this study, conducted by the Professor of Latin, is offered as an optional during the Senior year.

HEBREW.—An elementary course in Hebrew, conducted by the Chaplain, is offered as an optional study, open to Seniors and Juniors of the whole University.

ENGLISH.—During Freshman and Sophomore years, Rhetoric is studied, both with the aid of a text-book and through practical exercises. Careful training is given in essay writing throughout the course, and orations are written and delivered during Junior and Senior years. Excellence in Oratory is encouraged by the annual contest for the Alumni Prizes, held on the 22d of February and open to the Junior Class in all departments.

The Seniors receive instruction in the principles of versification and in extemporaneous discussion, and are

required to write a critique of some work selected for their examination.

The history of English literature and the philological history of the English language are studied during Junior year. These are supplemented by a series of lectures, extending through the second term, on the relations of literature to history. The course is completed by a series of lectures on English and American literature, delivered during the second term of Senior year.

ANGLO-SAXON.—An optional course in this subject is offered in Senior and Junior years.

MODERN LANGUAGES.—The study of modern languages is obligatory from the first term of the Sophomore year up to the close of the course. The student elects either French or German, or both, if time permits.

French.—The grammar is begun, reading being introduced immediately. The comparative and historical relations of the French to the English, and the connection of both with the Latin are carefully explained. As soon as possible the student is emancipated from the reader and takes up, in a progressive way, the reading of different authors; preference being given to modern writers, because it is considered to be of the highest importance that he acquire the language as it is, as an instrument whereby further knowledge can be obtained.

In the class-room, the language taught is used by the teacher as much as possible, in order that the ear of the pupil may become accustomed to its sound. Dictation is also employed, in order to give training in spelling. The rules of grammar are taught by numerous written exercises. In the second term of the Junior year, compositions in French are required, upon subjects which have been previously explained in French, in order that the student may become acquainted with different expressions and forms of construction. Before entering upon the study of an author's works, his life and literary achievements are discussed in

French, which is translated, if necessary. In the Senior year, twelve lectures are delivered upon the history of French literature. In addition to this, lectures in French upon the most distinguished modern authors are given to advanced students.

A weekly conversation-class affords opportunity for this kind of practice; and in it the events of the day and various historical and literary topics are discussed. Private courses of reading are also suggested to those who desire it.

German.—The German course follows the same plan as that laid down for the French, both as regards the methods employed and the opportunities afforded. The relations of English and German are dwelt upon and also those which connect the two languages with the Indo-European family.

MATHEMATICS.—The mathematical work is carried on during the Freshman and Sophomore years as follows:

Freshman year, first term, Chauvenet's Geometry, four exercises per week.

Second term, Olney's University Algebra; plane and spherical trigonometry, including mensuration and use of logarithmic tables, together five exercises per week throughout the term.

Sophomore year, first term, Olney's General Geometry and Davies' Analytical Geometry, four exercises per week.

Second term, Olney's Differential and Integral Calculus, four exercises per week. This term's work is elective for the Classical Course.

ASTRONOMY.—This study is taken up during the first term of the Senior year, Young's General Astronomy being used as the text-book. There are three exercises a week, and visits to the observatory help to make the work interesting as well as profitable.

CHEMISTRY.—This study includes a complete course of lectures in Freshman year upon general inorganic chemistry, in which the principles of the science are fully covered. These are illustrated by experiments, and are

sufficiently extended to enable a student who desires to pursue the subject further to take analytical chemistry as an elective in the second term of the Sophomore year. The text-book used in connection with the lectures is Remsen's Inorganic Chemistry.

PHYSICS.—This important subject is presented in a course of lectures during the first term of the Sophomore year, three times a week. These are illustrated by means of the very complete apparatus of the physical laboratory. In the course in Science and Letters, the work in this branch is more extended and is identical with that given to the Civil and Mechanical Engineers. It occupies five hours a week in the first term, when heat, magnetism, and electricity are discussed. Throughout the second term, three hours a week are devoted to sound and light.

GEOLOGY.—In the second term of the Senior year, a course of lectures is given in connection with Le Conte's text-book. The general principles of the science are explained, and the theories of the formation and stratification of rocks, the successive periods of the development of the earth's crust, the extinct forms of life and similar questions are treated.

PHYSIOLOGY AND HYGIENE.—These subjects are taught in a course of lectures during the Freshman year.

HISTORY, POLITICAL SCIENCE AND LAW.—The study of history begins with a course in the political antiquities of Greece and Rome. [See the Departments of Greek and Latin.] This is followed by the study of an outline of universal history (with text-book), and this by a fuller study of the political history of recent times, especially of that of England and France. During the first term of Senior year, there is a course of lectures upon the period covered by Gibbon's Decline and Fall of the Roman Empire. This prepares the way for a course of lectures on the philosophy of history, in which it is sought to set forth the scientific methods of the study of history.

The course in history is accompanied and supplemented by courses of lectures on constitutional law with special application to the Constitution of the United States; and also on international law.

Instruction is given by lectures on the elements of political economy. The student is made familiar with the facts, methods, and doctrines of the science, and is encouraged to form and present his own opinions.

LOGIC.—Junior Class, first term, two hours weekly. Textbook, Prof. Jevons' "Lessons in Logic," supplemented by occasional lectures and by references to more extended logical treatises, such as those of J. S. Mill, Sir William Hamilton, Archbishop Thompson, Baynes' Port Royal Logic, etc.

MENTAL AND MORAL PHILOSOPHY.—The work in this department will be conducted chiefly by lectures, interrupted by occasional examinations. The courses at present are the following:

Outlines of Physiological Psychology.—Junior Class, second term. These lectures are founded principally on Wundt's lectures on the same subject, given in the University of Leipzig in the Summer of 1888, Wundt's Grundzüge der Physiologischen Psychologie, James' Psychology, Baldwin's Handbook, Ladd's Elements of Physiological Psychology, Sully's Outlines of Psychology, Carpenter's Mental Physiology, Maudsley's Physiology and Pathology of the Mind, Bain's Mind and Body, etc., with references to the classical works of Lotze, Weber, Fechner, and Helmholtz.

The History of Philosophy.—Senior Class, both terms. First term, Ancient and Medieval Philosophy. Second term, Modern Philosophy. These lectures will include a statement of the conception and problems of philosophy, a brief sketch of the great ethnical religions, and of the history of Oriental philosophy. The philosophy of the Greeks will be treated in detail, with illustrations from the writings of the philosophers.

The history of medieval philosophy will be prefaced by a short description of the philosophical ideas underlying Christianity, and it will contain an account of the more important Church Fathers and Schoolmen.

The history of modern philosophy will begin by tracing the effect on philosophical thought of the ideas contributed by the Renascence and by the Reformation. From Lord Bacon on, a detailed history of the great modern philosophical systems will be given, which will be continued to those of our own times, including Mr. Spencer.

CHRISTIAN EVIDENCES. — Senior Class, second term. Lectures on Christian evidences, which will endeavor to treat of the subject both from the side of natural science and from that of biblical criticism.

No complete course in Ethics has as yet been established, but the history of ethics is included in the history of philosophy.

THE COURSE IN SCIENCE AND LETTERS

substitutes the following for the Latin and Greek:

DRAWING.—In the first term of the Freshman year the student is instructed in elementary projections, shading, and lettering.

ZOÖLOGY AND BIOLOGY.—The study of these subjects covers one year, beginning with the second term of Sophomore year. The work begins with a description of the various animal functions, and is extended to the comparative anatomy and physiology of the organs in typical species. Systematic zoölogy is then completed and followed by practical biology.

CHEMISTRY. — In addition to the course in general chemistry described above, three exercises a week in qualitative analysis are taken in the second term of the Freshman year.

MINERALOGY.—Instruction in mineralogy is given to the students in the Course in Science and Letters throughout

the Junior year. In the first term, they attend a course of lectures on crystallography, followed by a series of practical exercises in the determination of crystalline forms by the aid of models and natural crystals.

In the second term a course on the physical properties of minerals and on descriptive mineralogy, with the use of E. S. Dana's Text-Book of Mineralogy, is followed by practical exercises in the determination of minerals.

GEOLOGY.—The study of lithology is pursued in the first term of the Senior year, with laboratory practice, Williams' Lithology being used as the text-book. During the next term, the course given above is taken with the Classical and Latin-Scientific students.

THE CLASSICAL COURSE.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

Greek.—Homer: Odyssey. Prosody. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (3)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Pt. III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Greek.—Xenophon: Œconomicus. (3)

Latin.—Livy completed. Horace: Odes and Epodes. Composition and prosody. (4)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

English.—Rhetoric. Trench: English, Past and Present. (1)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's French Reader. (2) Or *German.*—Brandt's Grammar. Lodeman's Manual of Exercises. Buchheim's Reader. (2)

Greek.—Herodotus. (3)

Latin.—Horace: Satires and Epistles. Composition. (2)

History.—History of Rome. (1) Antiquities.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

French.—Grammar and reader (continued). (2) Or *German.*—Grammar, exercises, and reader (continued). (2)

History.—Weber's Outlines of Universal History. (2)

Greek.—Euripides: Medea. (3)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

In addition to the above exercises, four hours per week must be selected from the following elective studies:

Mathematics.—Differential and integral calculus: Olney. (4)

Greek.—Demosthenes: De Corona. (2)

Latin.—Plautus. (2)

French.—Grammar and reader. (2)

German.—Grammar and reader. (2)

Chemistry.—Stoichiometry and qualitative analysis (laboratory). (4)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Jevons's Lessons in Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Greek.—Sophocles: Antigone. Antiquities. (3)

Latin.—Letters of Cicero and Pliny. (3)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Buchheim's Prose Composition. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Greek.—Aristophanes: Clouds. Æschylus: Prometheus. (3)

Latin.—Persius, Plautus, and Terence. History of Roman literature. (3)

Literature and History. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Sadler; Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French literature. (2) Or *German.*—Grammar. Readings in Lessing, Herder, Goethe, Schiller, etc., and contemporary authors. Compositions. Lectures on German literature. (2) Conversation class in both languages optional throughout the year.

Greek.—Plato: Phædrus. Greek philosophy. (2)

Latin.—Lucretius, with lectures. Roman literature. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

French.—Readings. Compositions. Lectures in French on modern French authors. (2) Or *German.*—Readings. Compositions. Lectures in German on modern German authors. (2)

Geology.—Lectures. Le Conte. (2)

Greek.—Pindar: selected odes. Greek literature. (2)

Latin.—Cicero: De Officiis. Lectures on the History of Classical Philology. (2)

Lectures on American and English Literature. (2)

Critique, Poem, Oration.

Preparation of Thesis.

Gymnasium.

THE LATIN-SCIENTIFIC COURSE.

The Latin-Scientific Course, leading to the degree of Bachelor of Science (B.S.), is based on Latin without Greek.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

German.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (3)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

German.—Grammar. Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

Latin.—Livy (completed). Horace: Odes and Epodes. Composition and prosody. (4)

English.—Rhetoric. Trench: English, Past and Present. (1)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German.—Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

Latin.—Horace: Satires and Epistles. Composition. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney. (4)

French.—Grammar. Reader (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

History.—Weber's Outlines of Universal History. (2)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Jevons's Lessons in Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

Latin.—Letters of Cicero and Pliny. (3)
Essays and Original Orations.
Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)
Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)
English.—Earle's Philology of the English Tongue. (2)
French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)
German.—Readings (continued). Dictation. Compositions. (2)
Latin. — Persius, Plautus, and Terence. History of Roman literature. (3)
Literature and History. (1)
Essays and Original Orations.
Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)
History. — Decline and Fall of the Roman Empire: Gibbon. (3)
Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)
Astronomy.—Young's General Astronomy. (3)
French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Lectures on French literature. (2)
German.—Readings (continued). Compositions. Lectures on German literature. (1) Conversation class in both languages optional throughout the year.
Latin.—Lucretius, with lectures. Roman literature. (2)
Essays and Original Orations.
Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)
History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

Geology.—Lectures. Le Conte. (2)

Latin.—Cicero: De Officiis. Lectures on the History of Classical Philology. (2)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Lectures on American and English Literature. (2)

Critique, Poem, Oration.

Preparation of Thesis.

Gymnasium.

COURSE IN SCIENCE AND LETTERS.

The Course in Science and Letters, leading to the Degree of Bachelor of Science (B.S.), is designed for those who wish to pursue both scientific and literary studies without Latin and Greek. These being omitted, extended instruction is given in French and German, History, General Literature, Mathematics and General Science.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

German. — Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Elementary projections, shading and lettering. (2)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (2)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

History.—History of Greece. (2) History of Rome. (1)

German.—Grammar. Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German.—Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus. Olney. (4)

Physics.—Sound and light. Lectures and recitations. Barker's Physics. (3)

Zoölogy.—Lectures. Orton. (2)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

French.—Grammar. Readings (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. (2)

History.—Weber's Outlines of Universal History. (2)
English.—Readings in English classics. (1)
Essays.
Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Jevons's Lessons in Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

Zoölogy.—Lectures on biology. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Compositions. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

Literature and History. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French Literature. (2)

German.—Readings (continued). Compositions. Lectures on German Literature. (1)

In both languages conversation class optional throughout the year.

Geology. — Williams' Lithology and laboratory practice. (2)

Essays and Original Orations.

Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Geology. — Historic and dynamic geology. LeConte. (3)

Lectures on American and English Literature. (2)

Critique, Poem, Oration.

Preparation of Thesis.

Gymnasium.

THE SCHOOL OF TECHNOLOGY.

This school includes seven distinct courses:

I. The Course in Civil Engineering.
II. The Course in Mechanical Engineering.
III. The Course in Mining Engineering.
IV. The Shorter Course in Mining.
V. The Course in Electrical Engineering.
VI. The Course in Chemistry.
VII. The Course in Architecture.

These have the same curriculum of studies for the first term of the Freshman year; except that students who propose to take the course in Mechanical Engineering or that in Analytical Chemistry are required to take German. After the first term the student follows the program of the course which he has selected.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Chauvenet's Geometry (completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

French.—Whitney's Practical French Grammar. Super's Reader. (3) Or *German.*—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Free-hand sketching and lettering. (2)

English.—Rhetoric. (2)

Essays.

Physiology and Health.—Lectures. (1)

Gymnasium. (2)

THE COURSE IN CIVIL ENGINEERING.

The special technical studies in this course may be grouped under the heads of Surveying, Applied Mechanics, Road and Railroad Construction, Bridge Design, and Hydraulic and Sanitary Engineering.

The work in Surveying extends over four terms and embraces land surveying, leveling, topography, triangulation, railroad reconnaissance and location, hydrography, and the elements of geodesy. A large equipment of transits, levels, and other surveying tools affords students the opportunity of becoming familiar with the instruments of different manufacturers. Much time is devoted to practice in the field and drafting room, each student being required to become proficient in the use of instruments, in taking field notes, and in map-drawing. Particular attention is paid to the execution of topographical surveys and maps by the best modern methods. Railroad maps and profiles are made from actual field location. During the Senior year there is done secondary triangulation work of a high order of precision.

The work in Applied Mechanics comprises the strength and elasticity of materials, the theory of the equilibrium of arches, roofs and bridges, that part of the mechanics of machinery which relates to locomotives and hoisting machines, and the theory of hydraulics and hydraulic motors. Here the theoretical principles are illustrated by examples and problems taken as far as possible from actual engineering practice and a special report is required from each student on the testing machines of the Bethlehem Iron Company.

The course in Construction familiarizes the student with the qualities of materials used in engineering structures, with methods of preservation and testing, with masonry and foundations, and with the building and maintenance of roads and railroads. All the standard tests for hydraulic cements and mortars are made by each student.

The course in Bridge Design is preceded by the theory of computation of stresses by both analytical and graphic methods. Starting with the specifications for a first-class iron highway or railroad bridge, each student then makes the full computations, designs, working drawings, and bills of material for a plate girder, a lattice girder, and a pin-connected truss bridge. The weight of the designed bridge

is finally determined and compared with the dead load assumed for the calculations. The drawings are made and dimensioned in the same manner as in the drafting office of a bridge company. In connection with this course visits of inspection to bridges in the vicinity are regularly made.

The work in Hydraulic and Sanitary Engineering embraces the study of systems of water supply, the collection, purification, and distribution of water, the combined and the separate systems of sewerage, the methods for the disposal of sewage, and the best practice for the drainage and ventilation of houses. The hydraulic laboratory in the University Park affords opportunity for experiments on the actual measurement of water by means of weirs and orifices, and the testing of hydraulic motors.

Besides these special studies there is a course in astronomy, which includes practical work in the observatory. The study of English, and of French or German, is continued, and instruction is given during four terms in crystallography, mineralogy, lithology, and geology.

The student who completes all the studies of this course will receive the degree of Civil Engineer (C.E.).

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Construction.—Materials. Masonry. Carpentry. Roads and pavements. Sketches of structures. (2)

Drawing.—Descriptive geometry and isometric drawing. Tracings. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—Architectural drawing. Plans of piers and arches. Problems in stone cutting. Use of water colors. (4)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and light. Lectures and recitations. Barker's Physics. (3)

French.—Grammar. George Sand: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus, and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Surveying.—Triangulation. Topographical surveying with transit and stadia. Use of plane table. Topographical map. (4)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Construction.—Foundations. Specifications and estimates. Reports on structures. Tests of cements. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. Lectures on construction and maintenance. (4)

Roofs and Bridges.—Theory and calculations of stresses in roof and bridge trusses. Graphic statics. (5)

Sanitary Engineering.—Collection, purification and distribution of water. Systems of water supply. The combined and the separate system of sewerage. Disposal of sewage. House drainage. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Astronomy.—Young's General Astronomy. (3)

Bridges.—Suspension, continuous, and cantilever bridges. Design of plate girders and riveted bridges, with working drawings. (6)

Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (3)

Mechanics of Machinery.—Pile drivers, cranes and elevators. The mechanics of the locomotive. (2)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (2)

Gymnasium.

SECOND TERM.

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Bridges.—Design of pin-connected bridges, with working drawings and estimates. (3)

Hydraulics.—Hydrostatics. Efflux of water from orifices and flow in pipes and rivers. Hydraulic motors. (2)

Construction.—Theory and designing of retaining walls, stone arches, and masonry dams. Irrigation and water-supply engineering. (3)

Geology.—Historic and dynamic. Le Conte. (3)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN MECHANICAL ENGINEERING.

The object of this course is the study of the Science of Machines. The principal subjects taught are: The nature, equivalence, and analysis of mechanisms, the mechanics or theory of the principal classes or types of machinery, Mechanical Technology, and the principles and practice of Machine Design.

That the students may obtain the practical engineering data which they will most need when beginning their work as mechanical engineers they are required to pursue a course of Shop Instruction which does not necessarily involve manual labor and manipulation of tools, but is principally devoted to familiarizing them with those points in pattern-making, moulding, forging, fitting and finishing, which they need to know as designers of machinery. Particular attention is therefore directed to the forms and sizes of machine parts that can be readily constructed in the various workshops, to the time that it takes to perform, and the order of, the various operations, to the dimensions most needed by workmen and to the various devices for increasing the accuracy of the work, durability of the parts, and convenience of manipulation. This involves acquaintance with the processes and machinery of the workshops, but it is the foreman's and superintendent's knowledge which is required rather than the manual dexterity and skill of the workman and tool-hand. The acquirements peculiar to the latter are by no means despised and the students are encouraged to familiarize themselves therewith during leisure hours, but manual work in the shops forms no regular part of the course. On the contrary, the student enters the shop with hands and mind free to examine all processes, operations, and machinery, and is ready at the call of the teacher to witness any operation of special interest. Provided with note-book, pencil, calipers, and measuring rule, the student sketches the most important parts of the various machine-tools, notes down the successive steps of each of the important shop-processes as illustrated by the pieces operated upon, and follows the

pieces of work through the shops from the pig or merchant form to the finished machine.

That the students may learn to observe carefully and be trained to think and observe for themselves in these matters, there is required of them a full description of the various processes, operations, and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings, and finished pieces, which are not being constructed in the shops at the time and the blue prints for which have been given to them on entering the shops. The student's work is directed not only by these drawings and by the printed program given him at the start, but also personally by a teacher, who accompanies him into the shops, gives necessary explanations, and tests the extent and accuracy of his knowledge by examining the sketches and notes and by frequent questioning. Finally the results of the observations and the sketches are embodied in a memoir.

During the course there are frequent visits of inspection to the Bethlehem Iron Company, the L. V. R. R. Shops at Easton, and other engineering works both in and out of town, with special reference to such subjects as machine elements, prime movers, machinery for lifting, handling and transporting, and machinery for changing the form and size of materials. It is intended that each of these excursions shall have some definite purpose in view which must be fully reported by the students. These visits are also made the occasion for constant practice in the free-hand sketching of machinery.

The instruction in Machine Design begins with second term of the Freshman year and is continued throughout the course. At first tracings and blue prints of good examples of machine drawings are made. A thorough drill in projection drawing follows; in this work free-hand sketches are first made, and measurements taken, of machine pieces; these sketches are then converted into full-size working drawings. Then there is considerable practice in the interpretation of such drawings, and general views of lathes, planers, drills, and shapers are made from the draw-

ings of the details. This is followed by difficult projections and intersections and exercises in the empirical proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice and the drawings made full size. During the Junior year the class takes up the design of a high-speed steam engine, every dimension being determined by the students and complete drawings made. During the Senior year the students undertake the calculations, estimates, and working drawings involved in the design of a simple but complete machine, each student being engaged upon a different machine. From the finished drawings of each machine tracings are made and then blue prints taken for distribution among the other members of the class. In the case of the machines and of the engine the general plan or arrangement will be given to the students in the form of rough sketches, photographs, or woodcuts. In the last term the students are expected to make original designs for simple machinery, whose object has been fully explained. Throughout the course the work in the draughting-room is carried on as nearly as possible like that of an engineering establishment, and special attention is paid to methods of expediting the work of calculation by means of simple formulas, tables, and diagrams.

All the students in this course are required to study German.

The graduates in this course will receive the degree of Mechanical Engineer (M.E.).

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

German.—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing and Machine Design.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (5)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

Machine Design.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers, and connecting rods. (2)

Visits of Inspection.—Examination and sketching of principal machine parts in the shops of the vicinity. (2)

German.—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and Light. Lectures and recitations. Barker's Physics. (3)

German.—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Steam Engine.—Holmes' Steam Engine. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class optional throughout the year.

Mechanics of Machinery.—Hermann-Smith. Graphical Statics of Mechanisms. (2)

Mechanical Technology.—Shop instruction. Examination of the processes and appliances involved in pattern-making, moulding, forging, fitting, and finishing, with sketches and reports. (5)

Boilers.—Wilson. Strength, construction, and wear and tear of boilers. (1)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on experimental tests. (4)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

German.—Readings. Compositions. Lectures on German literature. (2)

Kinematics of Machinery.—Reuleaux. Nature and equivalence of mechanisms. (3)

Machine Design.—Calculations and working drawings for a high-speed steam engine. (5)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Machinery of Transmission.—Weisbach-Herrmann. (2)
Literature and History. (1)
Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Thermodynamics. — General principles; application to steam engines and air compressors. (3)

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Machine Design.—Calculations and working drawings for hoisting, pumping, and metal-working machinery. (4)

Kinematics.—Diagrams of the changes of position, speed and acceleration in mechanisms. Link and valve motions. Quick return motions. Parallel motions. Laying out of cams. (5)

Mechanics of Machinery.—Weisbach-Herrmann. Hoisting machinery, accumulators, cranes, and locomotives. (2)

Gymnasium.

SECOND TERM.

Mechanics of Machinery.—Weisbach-Herrmann. Pumps, pumping engines, blowing engines, compressors, and fans. (4)

Machine Design.—Original designs. (5)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (2)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Lectures on American and English Literature. (2)
Christian Evidences.—Lectures. (1)
Preparation of Thesis.
Gymnasium.

THE COURSES IN MINING ENGINEERING.

These courses aim to fit the student for practical work in either of the branches of mining, metallurgy, metallurgical chemistry, or geology. On account of the great number and scope of the studies necessary to the attainment of the degree of Engineer of Mines (E.M.), which includes that of Metallurgist, five years are required. At the end of the fourth year the student will have completed a course similar to that leading to the scientific degree in other institutions, and will receive the degree of Bachelor of Science (B.S.). On completing the first year, those who desire to practice mining alone are provided with a special course leading to the degree of Bachelor of Science (B.S.) in mining. The following program of subjects and studies shows the requirements for the degree of Engineer of Mines.

Modern Languages.—Although the option of studying French or German lies with the student, it may be well to note that the current literature of the subjects taught in these courses is more abundant in the latter language.

Drawing and Construction.—The course in machine design begins in the second term of Freshman year with tracings of good examples of machine drawings; then follow the interpretation of such drawings, and the making of general views of machines from detailed sketches; exercises in projection drawing from the same, and the proportioning of simple tools and machines. In Sophomore year the student becomes acquainted with the arrangement and details of metallurgical plant and in Senior year he designs the same. The post-graduate, during the entire year, becomes acquainted with and designs mining plant. The field work in mining and geological surveying is followed by map construction from field notes. Practice in mining and metallurgical construction is also afforded by the projects. In the shorter mining course, additional work in the construction of mining plant is introduced as early as the first term in Sophomore year.

CHEMISTRY. — The course in theoretical and applied chemistry extends over three years and includes work in wet and dry assaying of all the important ores and metallurgical products met with in actual practice, combined with the working of stoichiometric problems and the study of chemical philosophy. The practical work is that required for a metallurgical chemist or assayer.

With moderate care the expenses in this department need not exceed $120.

MINERALOGY.—This subject is divided into two courses. In the first course, after a short exposition of the laws of crystallography and a description of crystalline forms, practical exercises are held in the determination of simple and complex crystals, in which the student is taught to identify the various crystalline forms observed in minerals by the aid of models and of actual crystals, and with the use of the application goniometer. The second course includes the subjects of physical, descriptive, and determinative mineralogy. As in the first course, the greater part of the time is devoted to practical exercises, which, in this course, have for their object the determination of minerals. Each student is thus enabled to become familiar with the more common minerals by the actual handling of several hundred specimens, with the facility of making such tests as will not injure them. The presence of one or more instructors during each exercise permits the student to make frequent reports of his determinations, and to receive much instruction as to the characteristics of the minerals. The knowledge thus acquired can be supplemented by visits to the museum.

The course in blowpipe analysis may be considered as auxiliary to the practical exercises in determinative mineralogy. In the latter the student is urged to rely chiefly on physical tests; in the former he is required to determine minerals by the aid of the blowpipe.

The mineralogical laboratory offers facilities for an advanced course in crystallography and in physical and

microscopic mineralogy to a few students who may receive permission to pursue such a course.

GEOLOGY.—This subject is studied with special reference to the needs of the mining engineer. Within a radius of twenty miles the student meets and becomes acquainted with the rocks of the archæan, the palæozoic, and the mesozoic formations, and makes geological maps from his own field notes, paying attention to the lithological characters of the formations, as they are mainly non-fossiliferous south of the Blue Ridge. An extended practical course in lithology familiarizes the student with the rocks of importance to the mining engineer and enables him to determine them by sight. There are over 2000 specimens in the collection, embracing all the known species. The course in historic geology is illustrated by a cabinet of typical specimens. The course in economic geology supplements the above work by familiarizing the student with the geological horizon of all the valuable constituents of the earth's crust and the theories of their formation. As Bethlehem is near the center of the "extra-moraine" drift, exceptional facilities are afforded for the study of pleistocene geology in Eastern Pennsylvania.

ASTRONOMY.—After studying the theory of the subject two-thirds of the year are devoted to practical work in the observatory.

APPLIED MECHANICS.—This embraces hydraulics, a study of the steam engine, and the mechanics of machines employed in mining and metallurgy.

SURVEYING.—A course extending over three terms offers practice in land, mine, and geological surveying, leveling, topography, triangulation, railroad reconnaissance and location, and the use of the solar transit. It also includes practical work in drawing and map construction.

METALLURGY.—There are two courses of, together, about one hundred and forty lectures upon this subject, which

extend throughout a year. In these the chief object kept in view is a clear presentation of the principles involved in the various metallurgical processes, looked upon as the application to practice of the laws of chemistry, physics, and mechanics. This is followed, in the case of each process, by a description of the more important examples of the plant and of the methods of conducting the process, and by indications concerning its economic features. In order to ensure that the student shall understand the fundamental principles of metallurgy, and shall become so familiar with them as to be able readily to apply them, he is required to solve a series of problems in which these principles are involved. Many of the problems are such as are likely to present themselves to the metallurgist in his current practice.

The metallurgical laboratory affords opportunity for special investigations in subjects connected with metallurgy to such advanced students as are competent to conduct them.

MINING.—This subject is covered by three courses. The first begins with the application of economic geology to the needs of the engineer, so that he can study and value mining properties, locate appropriately the necessary plant, and calculate the cost of production. It includes the discussion of faults and the means of finding faulted bodies, with practical problems. The subjects of blasting, timbering, and winning deposits are applied to actual cases, as tunnel-driving, etc., and problems from practical data are solved by the students. The second course covers the subjects of underground and surface haulage; loading, unloading, and stocking ores; pumping; ventilation; hygiene and mining law. A series of problems is given in each of these subjects to cover cases that meet the engineer in ordinary practice. The third course treats of the mechanical preparation of ores by the wet, dry, or magnetic methods, and especially of the preparation of anthracite coal.

The location of the University in the vicinity of the iron works of the Lehigh Valley, and especially of the extensive

establishment of the Bethlehem Iron Company, affords unusual facilities for the practical study of iron metallurgy. The processes for the manufacture of spelter and oxide of zinc may be studied at the Bethlehem Zinc Works. The facilities for the practical study of mining and economic geology are not excelled by those of any other institution in the country. The zinc mines at Friedensville, the paint ores of the Marcellus formation, and the brown hematite and slate deposits of the Lehigh Valley are in the immediate vicinity, while within easy reach by rail are the semi-bituminous and anthracite coal fields, the block and fossil iron ores of the Clinton measures, the iron mines at Cornwall, Pennsylvania, and the iron and zinc mines of New Jersey; together affording examples of nearly all the methods of winning and dressing valuable deposits. Numerous visits of inspection are made in connection with the work of the course, to familiarize the student with metallurgical and mining processes and afford data for practical examples and projects.

THE COURSE IN MINING ENGINEERING.

This course is arranged so that the subjects which prepare the student for practice in the field of metallurgy shall be completed at the end of four years, when the graduate will receive the degree of Bachelor of Science in Metallurgy (B.S.). By remaining a year longer, and taking the subjects laid down for the post-graduate year, the graduate in the course may obtain the degree of Engineer of Mines (E.M.).

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

French.—Grammar and reader (continued). (3) *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches. General views from given details. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., illustrated from examples of mining and metallurgical plant. Graphical problems illustrating the direction and extent of throw in faults. (5)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—General views of metallurgical plant and detailed sketches. (2)

Surveying.—Theory and use of the level, compass, and transit. Surveys and maps of farms. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

Stoichiometry. (2)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Chemical Philosophy.—Tilden. Chemical calculations. Whiteley. (3)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2)

Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Fresenius' Quantitative Analysis. (4) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Copper ore (Cu).
3. Silver coin (Au, Ag, Pb, Cu).
4. Zinc ore (Zn). By both gravimetric and volumetric methods.
5. Bronze (Cu, Sn, Zn, Pb).
6. Spiegeleisen (Mn).
7. Lead ore (PbS).
8. Ilmenite (TiO_2).
9. Iron ore (complete analysis).
10. Limestone (complete analysis).
11. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).

Steam Engine.—Holmes' Steam Engine. (3)

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Literature and History.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, etc. (5)

Blow-Pipe Analysis.—Practice. (1)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Mechanics of Machinery.—Herrmann-Smith. The graphical statics of mechanisms. (2)

Chemistry. — Quantitative analysis: laboratory work: Fresenius. (3) The following analyses are executed by the student:

12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).

15. Nickel ore (Ni, Co).

16. Gas analysis.

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Gymnasium.

SECOND TERM.

Mining.—Prospecting. Economic geology. Boring. Valuation of property. Methods of mining. Lectures. (3) Mechanical preparation of ores. Coal washing. Lectures. (2)

Drawing.—Designing of furnaces and other metallurgical plant. (2)

Mechanics of Machinery.—Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

POST-GRADUATE YEAR.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (5)

Geology.—General geological definitions and principles. Dynamic geology. Le Conte. (2)

Drawing.—General views of mining plant and detailed sketches. (2)

Astronomy.—Young's General Astronomy. (3)

Surveying.—Triangulation. Leveling. Topographical surveys with transit and stadia. Topographical maps. (4)

SECOND TERM.

Geology.—Historic geology. Le Conte. (2)

Projects.—In geology and mining. Designing of mining plant. (3)

Surveying.—Geological survey: mapping and cross-sectioning. (2) Mine survey. Theory and practice, with construction of mine maps. Tunneling and shaft location. (2)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map and estimate of cost. Lectures on construction and maintenance. (4)

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Preparation of Thesis.

THE SHORTER COURSE IN MINING.

This course is so designed that the student who desires to pursue the practice of mining and ore-dressing, and who does not wish to take the full course, may be prepared for practice in four years, receiving the degree of Bachelor of Science in Mining (B.S.).

This course is identical with the preceding up to the end of the Freshman year.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Mining Technology.—Kinds and systems of timbering. Details of haulage and hoisting plant. Freehand, isometric, and detailed drawings. (5)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. (2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Geology.—General geological definitions and principles. Dynamic geology. Le Conte. (2)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Surveying.—Triangulation. Leveling. Topographical surveys with transit and stadia. Use of plane table. Topographical map. (4)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Geology.—Historic geology. Lectures. LeConte. Dana. (2)

Mining.—Prospecting. Economic geology. Boring. Valuation of property. Systems of mining. Lectures. (3)

Steam Engine.—Holmes' Steam Engine. (3)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. Lectures on construction and maintenance. (4)

Drawing.—Construction of mining plant and detailed sketches. (2)

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Literature and History.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (5)

Graphical Statics.—Graphical analysis of roof-trusses and girders. (2)

Astronomy.—Young's General Astronomy. (3)

Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (3)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Gymnasium.

SECOND TERM.

Mining.—Mechanical preparation of ores. Coal washing. (2)

Projects.—In mining. Designing of mining plant. (3)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Surveying.—Geological survey: mapping and cross-sectioning. (2) Mine survey. Theory and practice, with construction of mine maps. (2)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN PHYSICS AND ELECTRICAL ENGINEERING.

In the arrangement of the details of this new course the object has been to provide for those who seek to fit themselves as Electrical Engineers a preliminary training as complete and broad as that given to the members of the other schools. The requirements for admission, the mathematical and English studies, the modern languages and other outside branches are the same as those in the other technical courses. To these have been added such portions of the Mechanical Engineering Course, with which this course is most closely allied, as are necessary to give the student a general but sufficiently accurate knowledge of machinery.

This preparation joined to the unusually full development of Physics—and especially of Electricity—will, it is thought, make a course sufficiently comprehensive and thorough for the proper training of candidates for this degree. The great success attending the large majority of

the young men who have taken the one year's course in Electricity, in their subsequent electrical work, warrants the belief that this broader and more extended course will attain its object.

The main feature of this new course is the prominence given to the subject of Physics. This extends through three years, and while Electricity is specially developed the other branches, Elementary Mechanics, Heat and Light, are fully provided for. The opportunity is thus given to any one who wishes to acquire a more extensive knowledge of Physics than the University curriculum has heretofore offered. The student is well drilled in the theory by means of lectures and recitations, which carefully cover the whole subject, and he is required to go over the ground himself in the best of all schools—the working laboratory. Enough of work on each topic is given him to render him familiar with his subject. Much prominence is given to work that brings out the resources of the student himself, such as the construction of instruments and original investigation. He is encouraged to this and a regular portion of his time is set apart for this object.

It will be seen from the preceding statement that this course offers two great advantages: the thorough and extensive training of those intending to take part in the great development of Electric Science in the industrial field now going on and the facilities offered to those who wish to take a four years' course specially devoted to the whole branch of Physics.

The practical work of the Physical Laboratory is too extensive to allow of full details being given in the following arrangement of the course. The more important subjects developed may be mentioned here. In Mechanics, exact measurements, specific gravity, barometric leveling. In Heat, calorimetry and hygrometry. In Light, testing of optical instruments, spectroscopic analysis and photometry. In Meteorology, observations for several months as taken in the U. S. Signal Service stations, with all the usual corrections and reductions; construction of charts; mapping curves; reports, etc. In Magnetism, study of laws of force,

determination of moments of magnets and of horizontal components of intensity of earth's magnetism in absolute units. Attention is also given in the Junior year, both in lectures and laboratory work, to the investigation of the magnetic properties of iron magnetic moment, intensity of magnetization, magnetic induction, permeability, susceptibility, hysteresis, etc. In Electricity, management of batteries, construction of instruments and their calibration, measurement of resistance and other electrical measurements, electrolysis and relation of electrical currents to heat and mechanical work; study of direct and alternating current dynamos and motors and practical running, care and tests for efficiency, etc.; a determination of the resistance, characteristics, and saturation curves, exploration of field, coëfficient of magnetic leakage, etc.; electric lighting, with photometric tests of arc and incandescent lamps; measurement of heat units given off by lamps, their resistance (hot and cold); energy consumed in lamps; spectroscopic tests of purity of carbons; study of telegraph and telephone and of the application of electricity to street railways; visits to manufactories, working systems, electric railways, etc.

The work in Dynamo Design consists of a study of the principles of dynamo-electric machinery by lectures and recitations, and also of the practical calculation and design of dynamos for incandescent work, multipolar generators, stationary motors and street railway motors, alternate current apparatus, including generators, motors, and transformers. The design of street railway systems is also taken up, and long distance transmission by power. The preparation of the Thesis forms an important part of the work for the Senior year. It will consist of original investigation and research, in theoretical or applied electricity, approved by the professor of physics. The student is thrown upon his own resources as much as possible, and is made to rely on himself.

Through the generosity of members of the Board of Trustees, an important addition has been made to the apparatus of this department. It includes a 50 h. p. engine,

an 80 cell storage battery, some machines for advanced alternating current work, a 2-phase alternator and motor, etc.; a lathe and workshop tools, and a number of standard instruments of the finest kind for exact electrical measurements. This addition to the equipment of the department will enable it to carry out satisfactorily the advanced and broadened course which has been arranged for the present year.

A deposit of $20 for the first term and $15 for the second is required from each student before he is allowed to work in the laboratory. From this, at the end of the year, is retained the cost of any material wasted or apparatus injured by him during the term.

The degree of Electrical Engineer (E. E.) will be given to the graduates of this course.

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (2)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Descriptive geometry and isometric drawing. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat. Magnetism and electricity. Lectures and recitations; text-book, Barker's Physics. (3)

Mechanics, Sound and Heat.—(Physical laboratory.) (4)

Machine Design.—(2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Heat (continued), Magnetism, and Light.—(Physical Laboratory). (3)

Chemistry.—Lectures on Photography.

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Steam Engine.—Holmes' Steam Engine. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation, Compositions. (2) Or *German.*—Lessing, Herder, Goethe. Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Physics.—Electricity and Magnetism. Lectures with recitations; text-book, Slingo and Brooker's Electrical Engineering. (3)

Electricity; Electrical Measurements.—(Physical laboratory.) (3)

Meteorology.—Text-book and practice. (1)

Strength of Materials.—Elasticity and strength of wood, stone and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Boilers.—Wilson. Strength, construction and wear and tear of boilers. (1)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Dynamo Design.—Text-book, S. P. Thompson's Dynamo-electric Machinery, with lectures. (3)

Magnetic Properties of Iron.—Text-book, Ewing's Magnetic Induction in Iron. (2)

Electrical Measurements; Magnetic Properties of Iron. Physical laboratory. (4)

French.—Readings. Compositions. Lectures on French Literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Surveying.—Theory and use of instruments. Location and construction of electric railways. (2)

Applications of Electricity.—Telegraphs and telephones. (2)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Dynamo Design.—The design of continuous current apparatus, dynamos, multipolar generators, motors. (3)

Dynamic Machines and Electric Lighting.—Study of, practice in running and care of, determination of characteristic and saturation curves, exploration of field, etc. Tests of efficiency, photometric and spectroscopic tests of lamps, etc. (Physical laboratory.) (5)

Alternating Currents.—Recitations with text-book. (3)

Measurement of Power.—Indicating of steam engines and dynamometer experiments. (1)

Astronomy.—Young's General Astronomy. (3)

Mechanics of Machinery.—Herrman-Smith. The graphical statics of mechanisms. (2)

Gymnasium.

SECOND TERM.

Dynamo Design (continued).—Design of alternating current apparatus. (2)

Electric Railways.—Recitations. Plans for an electric railway, with maps, specifications, etc. Long distance transmission of power. (2)

Hydraulics.—Flow of water through orifices, pipes, and channels. Hydraulic motors. (2)

Lectures on English and American Literature. (2)

Christian Evidences. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN CHEMISTRY.

This course of study is designed to prepare students for the profession of the chemist, in connection with metallurgical establishments, sugar refineries, gas works, superphosphate works, electrical machinery manufactories, mining companies, etc., and the general consulting and analytical work of the professional chemist. It is also well adapted for the preparation of teachers of chemistry and as a preliminary course to the study of medicine. It is eminently practical, the student's time being largely occupied by practical work in the large, well equipped and well ventilated chemical laboratories, which were completed in

1885 and constitute the best constructed building for this purpose in this country. The museum of chemistry contains large collections of specimens, for illustrating the lectures on theoretical and applied chemistry.

THEORETICAL CHEMISTRY.—Instruction in this subject begins with lectures four times a week, in the first term of the Freshman year. These lectures are fully illustrated by experiments, colored diagrams, working drawings and lantern pictures, and specimens from the museum. They include a general introduction to theoretical chemistry, and a description of the non-metallic and metallic elements and their compounds, the general subject of inorganic chemistry. The students are required to take notes of the lectures, and to pass a written examination at the end of the term.

In the second term of this year stoichiometry and chemical problems and reactions are taught by recitations twice each week.

The study of theoretical chemistry is continued throughout the Sophomore year by recitations three times a week from Tilden's Chemical Philosophy, Whiteley's Chemical Calculations, and Remsen's Chemistry, in the first term of the Junior year, by a course of lectures and recitations on theoretical organic chemistry, four times a week and twice a week in the second term. These lectures are illustrated by experiments and by specimens from the museum of chemistry.

Written examinations are held at the close of each of the above courses.

ANALYTICAL CHEMISTRY.—Qualitative analysis is taught in the second term of the Freshman year, by lectures, recitations, and practical work in the qualitative laboratory, twelve hours of practical work per week being required. This laboratory is a large, well ventilated, and well lighted room, supplied with convenient working tables, vacuum filtration, hoods for noxious vapors, steam

baths, gas and washing appliances, and a commodious room for hydrosulphuric acid. Distilled water is delivered by faucet in this room and the other large laboratories. At the close of the term a practical examination is held in this subject.

After completing this course, quantitative analysis is pursued throughout the Sophomore and the first term of the Junior years. This subject is taught by lectures, recitations, and practical work in the quantitative laboratory, which is equipped similarly to the qualitative laboratory, but is supplied in addition with apparatus for drying precipitates and residues, rooms for the chemical balances, for combustions, and for a reference library.

Twelve hours per week are required during the first term of the Sophomore year and fifteen hours during the second term of that year and the first term of the Junior year.

The course consists in gravimetric and volumetric analyses, as applied to the substances given in the lists farther on, accuracy being required in the determination of each constituent.

At the close of each term written examinations are held upon the theory and practice of quantitative analysis.

Gas Analysis is taught by lectures and laboratory practice in the gas laboratory. This laboratory is supplied with full and complete apparatus for gas analysis, according to Bunsen's processes, as well as apparatus for some of the more rapid methods. Mixtures of gases are required to be analyzed by the students, within certain limits of error, and a written examination, on the theory and practice, is held at the close of the course.

Assaying.—The assaying of ores by furnace assay, together with gold and silver bullion analysis, by processes practiced in the United States Mint, is taught by lectures and practical work in the first term of the Senior year, nine hours of practical work per week being required. The course includes the assaying of ores of lead, tin, anti-

mony, gold, silver, and iron, coal, and gold and silver bullion.

The assaying laboratory is supplied with large working tables, twenty-nine crucible and two iron furnaces, and eight muffle furnaces, with adjoining rooms for balances, and gold and silver bullion analysis.

A certain accuracy of results and a written examination as regards theory and practice are required.

ORGANIC CHEMISTRY.—The practical work in this subject is performed in the second term of the Junior year, fifteen hours per week being required, with conferences and recitations each week. The laboratory for this work is equipped similarly to the quantitative laboratory, in addition being supplied with steam, cold water and air blast upon the working tables, and a full supply of apparatus for the various determinations and experiments, including combustion furnaces, furnaces for heating sealed tubes, mercury pump, Hoffman's, Dumas' and Meyers' apparatus for vapor densities, nitrometers, chemical balances, etc.

The course consists of determinations of specific gravities, melting points, boiling points, vapor densities, chlorine, bromine, iodine, and sulphur of organic substances.

Combustion analysis, nitrogen determination, fractional distillation, and the preparation of fifty pure organic compounds and a number of analyses are included.

INDUSTRIAL CHEMISTRY.—A course of lectures is delivered upon this subject in the second term of the Senior year, illustrated by experiments, diagrams, lantern pictures, and specimens from the museum of chemistry. The working laboratories for this subject contain an apparatus for making illuminating gas, an alcohol still, worm and doubler, and a complete working model of a sugar refinery, including filters, vacuum pan, and centrifugal. There is also apparatus for use in the manufacture of chemicals, for dyeing, calico printing, and bleaching. In connection with these laboratories is a room containing a photometer and apparatus for determining the sulphur, ammonia, and

specific gravity of illuminating gas; also a laboratory for the testing of alcoholic liquors, sugar, molasses, bone black, soap, petroleum, paints, dyes, superphosphates, and other commercial products, with the necessary technical apparatus. The students make practical experiments in this direction, and, with an instructor, visit various industrial establishments in this neighborhood and in and around New York City.

TOXICOLOGY.—A course of lectures on this subject is given in the first term of the Junior year, illustrated by experiments and by the large collection of specimens of poisons from the museum of chemistry. This is supplemented by a short course of laboratory work on some of the common poisons.

SANITARY CHEMISTRY.—During the second term of the Senior year attention is given to the qualitative and quantitative examination of air, water, food, disinfectants, and other subjects connected with this branch of the science. Special apparatus is provided for this work, as recommended by the best authorities on the subject.

PHOTOGRAPHIC CHEMISTRY.—A well equipped photographic laboratory and dark rooms are provided, in which the students of the chemical course receive practical instruction.

PHYSIOLOGICAL CHEMISTRY.—The examination of urine, blood, etc., receives a proper amount of attention.

The course also includes instruction in physics, mineralogy, blowpipe analysis, metallurgy, and geology, which are of great value to the chemist.

MICROSCOPY.—Instruction in the use of the microscope is given in the first term of the Senior year.

In the Senior year the student is required to prepare a thesis on some subject, selected by the Professor of Chemistry, involving practical work in the laboratory in addition to the literary labor, each graduate thus making a contri-

bution to the progress of the science, as a preliminary to the reception of his degree.

The graduate of this course receives the degree of Analytical Chemist (A.C.).

Students, not candidates for a degree, are admitted for special courses in chemistry, of which they will receive certificates.

The laboratories are under the immediate charge of the Professor and Instructors of Chemistry and are open to the students from 8 o'clock A.M. to 6 o'clock P.M., including Saturdays. Students are at liberty to work in the laboratories beyond the required hours as their time may permit. Students are charged for materials and apparatus consumed; with moderate care this expense need not exceed $50 per year.

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

German.—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Stoichiometry. (2)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Chemical Philosophy. — Tilden. Chemical calculations. Whiteley. (3)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (4)

The following analyses are executed by the student:

1. Iron wire (Fe).
2. Potassium dichromate (Cr_2O_3).
3. Barium chloride (Ba, Cl, H_2O).
4. Magnesium sulphate (MgO, SO_3, H_2O).
5. Disodium hydrogen phosphate (P_2O_5).
6. Rochelle salt (K_2O, Na_2O).
7. Volumetric determination of chlorine.
8. Acidimetry (HCl, H_2SO_4, HNO_3, $HC_2H_3O_2$).
9. Alkalimetry (KOH, NaOH, NH_4OH, soda ash, pearl ash).
10. Chlorimetry (bleaching powders).

Quantitative Analysis.—Conference. (1)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

German.—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Physics.—Sound and light. Lectures and recitations. Barker's Physics. (3)

German.—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

11. Copper ore (Cu).
12. Zinc ore (Zn). By both gravimetric and volumetric Methods.
13. Lead ore (Pb, S).
14. Silver coin (Au, Pb, Ag, Cu).
15. Spiegeleisen (Mn).

16. Copper alloys (complete analysis).
17. Ilmenite (TiO_2).
18. Iron ore (complete analysis).
19. Limestone (complete analysis).
20. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).
21. Slag (complete analysis).

Quantitative Analysis.—Conference. (1)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Remsen. Advanced course. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Toxicology.—Lectures. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

22. Guano (NH_3, P_2O_5, H_2O).
23. Clay (complete analysis).
24. Manganese ore (MnO_2).
25. Mineral water (complete analysis).
26. Pig iron (complete analysis).
27. Nickel ore (Ni, Co).
28. Carbon in steel (volumetric).
29. Gas analysis.

Quantitative Analysis.—Conference. (1)

Organic Chemistry.—Lectures and recitations. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Organic Chemistry.—Laboratory. (5)

Organic Chemistry.—Lectures and conferences. (2)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

German.—Readings. Compositions. Lectures on German literature. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. E. S. Dana. (3)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, etc. (5)

Assaying.—Including the assay by the dry method of gold, silver, antimony, lead, iron, and tin ores, coal, gold and silver bullion, and rich lead. Ricketts. (3)

Industrial Chemistry.—Laboratory. (3)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Microscopy.—Laboratory. (2).

Preparation of Thesis.

Gymnasium.

SECOND TERM.

Industrial Chemistry.—Lectures. (3)

Industrial Chemistry.—Laboratory. (3)

Industrial Chemistry.—Conference. (1)

Agricultural Chemistry.—Laboratory. (1)

Sanitary Chemistry.—Laboratory. (1)

Geology.—Historic and dynamic geology. Lectures. LeConte. (2)

Christian Evidences.—Lectures. (1)

Lectures on American and English Literature. (2)

Preparation of Thesis. (2)

Gymnasium.

THE COURSE IN ARCHITECTURE.

The studies in this course are closely allied with those in civil engineering, the higher surveying, railroad work, mineralogy, geology, and astronomy being omitted, instead of which architectural drawing and designing is substituted as seen in the following program. Instruction is also given in the history and æsthetics of architecture, in methods of heating and ventilating, in boilers and hoisting machinery, and in house drainage and sewerage.

During the first and second years the student lays the foundation for his professional work by the study of mathematics, physics, mechanics, drawing, surveying, English, and French or German. The course in drawing includes the use of water colors, free-hand, projection and isometric drawing, and their application to the general plans for a small building. In surveying there is field practice in the use of instruments, and also map drawing, thus enabling the student to understand the application of the subject to landscape gardening, and to the location of buildings.

During the third and fourth years of the course the work is of a more professional character. The subject of construction familiarizes the student with brick, stone, cement, and other materials, with foundations and masonry, with arches, piers, and walls, and with the stone-cutter's art. There is a full course in the theory and calculation of columns, beams, and shafts, in the strength of materials and its application to roof trusses and bridges. Working drawings of arches, piers, and roof trusses are made in detail. Plans and estimates are prepared for wooden, brick, stone, and iron buildings, the work being done according to standard specifications. In connection with the course visits of inspection are made to the numerous engineering structures in the Lehigh Valley and vicinity.

The student who completes all the subjects of this course will receive the degree of Bachelor of Science in Architecture (B. S.).

FRESHMAN CLASS.

FIRST TERM.

See Page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Construction.—Materials. Masonry. Carpentry. Roads and pavements. Sketches and structures. (2)

French.—Grammar and Reader (continued). (3) Or *German.*—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Descriptive geometry and isometric drawing. Tracings. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—Architectural drawing. Plans of piers and arches. Problems in stone cutting. (4)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and light. Lectures and recitations. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus, and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Construction.—Foundations. Specifications and estimates. Reports on structures. Tests of cements. (2)

Drawing.—Shades, shadows, and linear perspective. Sketches and designs for ornaments and simple details. (6)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Roofs and Bridges. — Theory and calculation of stresses in roof and bridge trusses. Graphical statics. (5)

Sanitary Engineering. — Collection, purification, and distribution of water. Systems of water supply. The combined and the separate system of sewerage. Drainage and sewerage of buildings. (2)

Architecture.—Designs and estimates for brick and stone buildings. (4)

History.—The history and styles of architecture. (2) Lectures on Roman antiquities. (1)

Literature and History. (1)

Gymnasium. (2)

SENIOR YEAR.

FIRST TERM.

Roofs and Bridges. — Cantilever, suspension, and arch bridges. Designs for plate girders and riveted roof trusses. (6)

Mechanics of Machinery.—Pile drivers, cranes, and elevators. (2)

Boilers.—Strength, construction, and wear and tear of boilers. Wilson. (1)

Architecture. — Specifications and estimates. Design for an iron building. (5)

Heating and Ventilation.—Systems of heating, lighting, and ventilating buildings. (2)

Gymnasium.

SECOND TERM.

Hydraulics. — Efflux of water from orifices, and flow in pipes and channels. Hydraulic motors. (2)

Construction.—Retaining walls, masonry dams, and stone arches. Plans and estimates. (3)

Roofs and Bridges.—Design for a pin-connected roof truss, with working drawings and estimates. (3)

Architecture.—Building superintendence. The æsthetics of architecture. Original plans, estimates, and specifications. (4)

Lectures on English and American Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

PHYSICAL CULTURE.

The Gymnasium is open morning, afternoon and evening, in all, 45 hours a week. Exercise in it is required of all students who are fitted to take it. Class drill with the Instructor and individual exercise are prescribed.

GRADUATING THESES.

Every student will be required to present a thesis upon some topic connected with his special course, as a necessary portion of the exercises for his final examination for a diploma. These theses shall be accompanied by drawings and diagrams, when the subjects need such illustration. The originals will be kept by the University, as a part of the student's record, for future reference; but a copy may be retained by the student, and be published, permission being first obtained from the President.

DIPLOMAS AND CERTIFICATES.

The Diploma is given only to those who have passed all the examinations in a regular course and is signed by the Secretary of the Board of Trustees and by the Faculty of the University. For all the partial courses a certificate is given, signed by the Secretary of the Faculty, and showing what the student has accomplished.

GRADUATE STUDENTS.

Graduate students wishing to remain a year or more and pursue a course of study as candidates for another Degree

may do so with the sanction of the Faculty. Those wishing to take *special* courses of study will be afforded every facility for so doing.

POST-GRADUATE DEGREES.

M. A.

The Faculty will recommend for the Degree of Master of Arts any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Arts, shall pursue, for at least one year at this University, or two years elsewhere, a course of liberal study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same, and present a satisfactory Thesis.

M. S.

The Faculty will recommend for the Degree of Master of Science any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Science, or any Degree in the School of Technology, shall pursue, for at least one year at this University, a course of study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same and present a satisfactory Thesis.

The Theses presented by candidates for Post-Graduate Degrees shall be retained by the University.

Applicants for either of these degrees will be required to complete the prescribed work within the allotted time. Special action of the Faculty is required for any extension of time.

THE UNIVERSITY LIBRARY.

The Library building was erected by the Founder of the University in 1877, at a cost of $100,000, as a memorial of his daughter, Mrs. Lucy Packer Linderman, and during the same year more than $20,000 were contributed by her family and friends as a memorial fund for the purchase of

books. By the will of the Founder of the University a fund of $500,000 has been given for the permanent endowment of the library.

The building is semi-circular in plan, with a handsome façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior, the center is occupied as a reading space, fifty by forty feet, from which radiate the book cases, extending from floor to ceiling; two galleries affording access to the upper cases. Shelf room is now provided for one hundred and sixty thousand volumes. The building is thoroughly fireproof, well lighted, and heated by steam.

Ninety-seven thousand volumes are now upon the shelves, including many extremely valuable works. The list of periodicals numbers about two hundred and fifty, embracing as far as possible all departments of knowledge.

The Library is conducted strictly for consultation, and is open to the use of the public; both of which conditions are in accord with the terms of the gift.

REGULATIONS OF THE LEHIGH UNIVERSITY LIBRARY.

I. The Library is open every day, except Sundays and Legal Holidays, from 8 A.M. until 10 P.M., and on Sundays for the students and others connected with the University from 1.30 P.M. until 9.30 P.M.

II. Admission is free to all persons over 16 years of age.

III. Readers are required to write their names and addresses in the Daily Register of the Library. They also write the name of the book desired upon a Library Card, with their signatures, and present the same to the Director's Clerk, who supplies the book, retaining the card as a receipt. Before leaving the Library, readers return their books to the clerk, and receive their cards.

IV. The University Professors and Instructors, only, are allowed to take books from the Library Building.

V. No person is allowed to enter the alcoves, or remove any book from the shelves, without permission of the Director.

VI. Readers wishing to consult the more valuable illustrated works make special application for that purpose.

VII. In taking notes, pencils, and not pens and ink, are to be used.

VIII. Audible conversation and the use of tobacco are strictly forbidden in any part of the Library.

IX. Any person not conforming to these Regulations will be denied the privilege of the Library.

X. Any person who defaces, in any way, any book, magazine or paper, or the furniture, or any portion of the building, in addition to being deprived of the privileges of the Library will be prosecuted according to law.

OBSERVATORY.

By the liberality of Robert H. Sayre, Esq., one of the Trustees of the University, an astronomical observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

In the dome of the observatory is mounted an equatorial telescope, of six inches aperture, by Alvin Clark & Sons. The west wing contains a superior sidereal clock, by Wm. Bond & Sons; a zenith telescope, by Blunt, and a field transit, by Stackpole. There is also a prismatic sextant, by Pistor & Martins.

Students in practical astronomy receive instruction in the use of the instruments and in actual observation.

The grounds upon which the Observatory stands, consisting of seven acres of land adjoining the original grant, were presented to the University by Charles Brodhead, Esq., of Bethlehem.

THE UNIVERSITY MUSEUM.

In addition to the large collection illustrating all branches of Industrial Chemistry, the Museum includes collections in Metallurgy, Geology, Zoölogy, and Archæology.

The Metallurgical Cabinet already includes specimens illustrating the various processes for obtaining the more common metals.

The Zoölogical Cabinet includes the Werner collection of nearly all the types of American birds with their nests and eggs, and the Packer collection of recent shells.

The Geological Cabinet numbers over ten thousand specimens and includes the Palæontological, Mineralogical, Petrographic, and Economic collections. The first contains good specimens of nearly all the common genera. The Mineralogical division includes the Keim and Rœpper collections—the latter being especially complete and valuable from a crystallographic standpoint. The Petrographic division numbers several thousand specimens and, besides including numerous varieties of nearly all the rocks of the globe, contains a duplicate set from the collection of the Second Geological Survey of this State. The Economic division was formed and donated by Dr. James P. Kimball, ex-Director of the Mint, and formerly Professor of Economic Geology.

The Cummings Archæological Cabinet numbers three thousand specimens and includes Dr. Stubbs' collection of Indian relics, weapons, and utensils.

SUMMER SCHOOL OF SURVEYING.

A Summer School of Surveying, extending over a period of four weeks, is held at the University during the long vacation, provided that the attendance of at least twelve students is assured. In 1895 the school will open on Monday, June 24, at 8:30 A.M. Applications to join it should be made to the Professor of Civil Engineering before June 1, 1895. The tuition fee is $15, payable in advance.

Three courses in Surveying are offered in the Summer School:

A. Land and Town Surveying: corresponding to the course given to civil engineering students in the second term of the Sophomore year. This course is open to any student who has completed the Freshman year, or to any person having a good knowledge of geometry and trigonometry.

B. Topographical Surveying: corresponding to the course given to civil engineering students in the first term of the Junior year. This course is open to those who have completed course *A* or its equivalent.

C. Geodetic Surveying: corresponding to the course given to civil engineering students in the first term of the Senior year. This is open to those who have completed courses *A* and *B*.

At the close of the Summer School examinations are held and certificates given. Students of the University holding these certificates may omit the corresponding work in Surveying during the academic year and may, with the sanction of the Faculty, use the time thus gained in extra studies.

THE CHEMICAL AND NATURAL HISTORY SOCIETY OF THE LEHIGH UNIVERSITY.

This Society was organized in the Fall of 1871, as "The Chemical Society," but was afterwards expanded, as its present title indicates, and admits, by election, students from all departments of the University.

The collections of botanical and zoölogical specimens belonging to the Society are already important. During the past years persons have been sent to Texas and Brazil to collect specimens for these cabinets.

The Society has organized and maintained several courses of public scientific lectures.

Among the honorary members of the Society are more than one hundred of the most distinguished scientists in Europe and the United States.

THE ENGINEERING SOCIETY.

This Society was organized in 1873, and admits, by election, students in the Junior and Senior Classes. Its meetings are held fortnightly. At these, papers relating to engineering subjects are read and discussed. From 1885 to 1890 it issued quarterly five volumes of "The Journal of the Engineering Society," containing contributions by the members, alumni, and others. Many of the papers read before this society since 1890 have been published in "The Lehigh Quarterly," a journal published by the students of the University.

THE MINING CLUB.

This was organized in 1883 and takes from the Junior, Senior, and Post-Senior Classes those members of the Mining School who excel in their studies or in practical experience in the subjects of the course.

THE ELECTRICAL ENGINEERING SOCIETY

was organized in November, 1887, by students in the Advanced Course in Electricity. Its object is to supplement the regular work of the department by the study and discussion of electrical subjects.

THE AGORA

is a literary and debating society which meets semi-monthly. Once restricted in its membership to students in the School of General Literature, in 1893 it was thrown open to all the students. It has proved of great advantage to its members in the development of concise and logical

thinking, the promotion of ease before an audience, and the acquirement of experience in parliamentary methods. The society has recently joined the Inter-collegiate Debating Union, and it is expected that this will increase the interest already existing, and at the same time enlarge the knowledge of current affairs by the discussion of those subjects of the day which are prescribed by the Union.

THE CLASSICAL CLUB.

This organization was founded in the Spring of 1889, and consists of the students in the Classical and Latin-Scientific Courses, together with those members of the Faculty who are interested in this department of learning. At its monthly meetings, papers upon philological, historical, and archæological subjects are read by students belonging to the upper classes, and are then discussed and criticised. Thus independent work is encouraged and correct methods of investigation are acquired. This is especially valuable for those men who purpose becoming teachers or original investigators. Reports upon new discoveries and reviews of recent books vary the proceedings and keep the members informed in regard to the advances of philological science.

THE NATURAL SCIENCE CLUB OF THE LEHIGH UNIVERSITY.

The object of this organization is systematic study, in connection with field work, in natural history and its associated subjects. Its members are engaged in making a survey, both botanical and mineralogical, of the region within a radius of five miles from the University and propose to collect an herbarium and mineralogical cabinet which shall contain specimens of all the plants and minerals within this district.

THE ARCHITECTURAL CLUB.

This club was formed for the purpose of collecting photographic plates of buildings and plans, and to distribute

prints of these among its members. Working drawings, models, and specimens of building materials have also been collected. During the past year a series of monthly competitions in pen and ink drawings was held. The active members of the club are students in the architectural and engineering courses.

THE LEHIGH UNIVERSITY CHRISTIAN ASSOCIATION.

This is a voluntary organization of the students for the promotion of the religious, moral, and social life in the University. It was organized April 18, 1890, and on Oct. 11, 1890, united itself with the Intercollegiate Young Men's Christian Association. The movement is distinctly for and by students, all the officers being chosen from the student body. Those connected with Evangelical churches of whatever creed are eligible to *active membership; associate membership* may be claimed by men of good moral standing who are not members of churches. The association is continually growing, and is extending a marked influence for good among the men.

THE BIBLE CLASS.

A class for the reverent study of the sacred Scriptures, under the direction of the Chaplain, meets every Sunday afternoon at half past three o'clock. This class aims at both practical and theoretical results—the edification of its members in the Word of God, and the application of the (so-called) "scientific" or "historical" method to the study of Holy Writ.

FOUNDER'S DAY.

On the second Thursday of October of each year, Commemorative Exercises are held in honor of the Founder of the University. On Thursday, October 12, 1894, the sixteenth Founder's Day was celebrated. An address was delivered by La Rue Munson, Esq., of Williamsport, Pa.

UNIVERSITY SERMON.

This sermon is preached on the Sunday before University Day.

The Rt. Rev. Hugh Miller Thompson, S.T.D., LL.D., Bishop of Mississippi, was the preacher on Sunday, June 17, 1894, in the Memorial Church.

THESES.

Theses on the following subjects were prepared by candidates for degrees in 1894:

FOR THE DEGREE OF M.S.

"Reaction of certain alcohols on meta-diazo-benzene-sulphonic acids."

HERMAN EUGENE KIEFER, A.C.

FOR THE DEGREE OF B.A.

"The personality of George Eliot."

WILLIAM SPENCER MERRILL.

FOR THE DEGREE OF C.E.

"Review of the South Mountain Water Works, South Bethlehem, Pa."

LAWRENCE CALVIN BRINK.

"Gaugings of the Lehigh River above Calypso Island at Bethlehem."

EMOTT DAVIS BUELL.

"The stresses caused by suddenly applied loads and by impact."

JAMES LINDSEY BURLEY.

"The proposed ship canal between the Delaware and Raritan Rivers."

ALDEN BROWN DIVEN.

"Method for strengthening the Broad street bridge in Bethlehem."

WALTER JULES DOUGLAS.

"Design and detail drawings for a highway bridge of 198 feet span."

WALTER SEWELL DUNSCOMB.

"Design for a steel highway bridge over the Chemung River at Elmira, N. Y."

THADDEUS PERCIVAL ELMORE.

"Gaugings of the Lehigh River near the New Street bridge, Bethlehem; and a comparison of different kinds of floats."

JAMES DUBOSE FERGUSON.

"Experiments on the hydraulic jump, with a discussion and comparison of different theories."

ROBERT FERRIDAY.

"Design of two stone arches to replace a plate girder."

WILLIAM MCCLEERY HALL.

"Experiments on the lateral pressure of sand."

ANTON YOST HESSE.

"Stand pipes *versus* elevated tanks, with respect to economy."

FOSTER HAVEN HILLIARD.

"Review of the new bridge at West Catasauqua, Pa."

RICHARD WARREN KNIGHT.

"Precise leveling between South Bethlehem and Allentown, with a discussion of the errors."

CLAUDE AVERETT LANGDON.

"Review of the new highway bridge over the Lehigh River at Hokendauqua, Pa."

HARRY DONALDSON LEOPOLD.

"Design of a 50-foot drawbridge for class instruction and erection practice."

CARL WILLIAM FREDERICK NEUFFER.

"Plan for a sewerage system for Shenandoah, Pa."

JEREMIAH FRANCIS O'HEARN.

"Design of a separate system of sewerage for Pine Grove, Pa."

EDGAR EARNEST SEYFERT.

"Review of the plant of the Spring Brook Water Company, Pittston, Pa."

JACOB DANIEL VON MAUR.

"Discussion of a line of stadia levels from South Bethlehem to Allentown, Pa."

ALONZO LEACH WARE.

"Review of the sewerage system of Lehigh University."

AUBREY WEYMOUTH.

"Measurement of base lines by wooden rods and by tapes."

THOMAS WILLIAM WILSON.

"Plan for a new water supply for Bethlehem, Pa."

WELDON BURRIS WOODEN.

FOR THE DEGREE OF M.E.

"Production of solid steel castings."

IRVIN ISAAC BEINHOWER.

"A system of hydraulic cranes and accumulator for steel works."

THOMAS JOSEPH BRAY, JR., and
CLARENCE OLIVER LUCKENBACH.

"Design of 25 h. p. launch equipment."

REZEAU BLANCHARD BROWN, and
FRANK WILLIAM ROLLER.

"Experiments on effects of pipe connections on indicator diagrams."

BAYARD GUTHRIE.

"The direct conversion of heat into electrical energy."

FRANK WIESEMAN GLADING.

"Electric overhead traveling cranes."

MATTHIAS HARRY HOLZ.

"Efficiency of the locomotive boiler."
ALFRED A. HOWITZ.

"A feed water heater for locomotives."
GEORGE CASS HUTCHINSON.

"Economy of compound locomotives."
WILLIAM HARRISON KAVANAUGH.

"Fly-wheel acceleration permissible with incandescent lighting."
JAMES EDWIN LITTLE, and
WALTER CHRISTIAN SWARTZ.

"Methods of refrigeration."
JOHN VAN SICKLE MARTENIS, and
EDWIN GRAY RUST.

"Design of a tablet-compressing machine."
BENJAMIN FERDINAND SCHOMBERG.

"Hardening and tempering of steel."
ORSON WILLIAM TRUEWORTHY.

FOR THE DEGREE OF B.S.

(IN METALLURGY.)

"The tin plate industry."
WILLIAM A. ALLGAIER.

"Metallic carbonyls and their application to Metallurgy."
BARRY HOLME JONES.

"The desilverization of base bullion at the works of the Balbach Refining Co., Newark, N. J."
JOSEPH O. MATHEWSON, JR.

"The treatment of the zinc crust formed in Parkes' process as conducted by the Balbach Refining Co., Newark, N. J."
MATTHEW MCCLUNG, JR.

"Determination of the coefficient of discharge of a blowing engine supplying a blast furnace of the Thomas Iron Co."
GODWIN ORDWAY, and
CHARLES H. THOMPSON.

"The construction and testing of a new form of manometer."

WILLIAM VAUGHAN PETTIT.

FOR THE DEGREE OF B.S.

(IN MINING.)

"The drainage of the Friedensville zinc mines, and a system of water-supply therefrom."

GEORGE WASHINGTON SCOTT BATON.

"Rock-chute mining."

CHARLES BEECHER RUTTER.

"Experiments in the separation of slate from coal."

RUEL CHAFFEE WARRINER.

FOR THE DEGREE OF E.E.

"The design of an incandescent dynamo."

WILLIAM CONKLIN ANDERSON.

"Design of dynamo for incandescent lighting."

THEODORE GWATHMEY EMPIE.

"An incandescent light plant for Berwick, Pa."

FRANK FAUST.

"The Saucon Valley Traction Co."

JOHN JACOB FRANK.

"Design of a bipolar direct current dynamo."

LUTHER L. GADD.

"Original forms of telephones."

ELWOOD ARISTIDES GRISSINGER.

"Distribution of potential about commutators of dynamo machines."

FLETCHER DICKERMAN HALLOCK.

"Design of a constant potential dynamo."

WILLIAM EMLEY HOLCOMBE.

"An investigation of the iron losses in a transformer."

ARTHUR WILLISTON HENSHAW.

"The determination of magnetic hysteresis in certain specimens of iron."

JOHN DOUGLAS MCPHERSON, JR.

"Design of a 5-horse power electric motor."

CHARLES ASHER MOORE.

"Design of a switchboard for the Physical Laboratory of Lehigh University."

JULIUS LEDERER NEUFELD.

"Efficiency tests of batteries."

CHARLES ATWOOD NEWBAKER.

"Investigation of the magnetic leakage of a Westinghouse pony alternator and an Edison motor."

THOMAS CHARLES RODERICK.

"Design of an 80-horse power locomotive."

GEORGE ELWOOD SHEPHERD.

"Underground feeders."

CHARLES ELDER SHIPLEY.

"An electric road from Bethlehem to Freemansburg."

FREDERICK GEORGE SYKES.

"The lighting plant of a war ship."

PHILIP HENRY TROUT.

"Design of an electric railroad for the haulage of coal in the South Wilkes-Barre mines."

CLARENCE PORTER TURNER.

"The design of an incandescent dynamo."

CHARLES W. UNDERWOOD.

"Tests of the Westinghouse stopper lamp."

EDWARD OLMSTEAD WARNER.

FOR THE DEGREE OF A.C.

"The condensation of aldehydes with β-hydroxy α — naphthoquinone. The conversion of ortho- into para-, and of para- into orthoquinone derivatives."

WILLIAM COLWELL CARNELL.

"Fernaline."
MILTON BRAYTON GRAFF.

"Indigo."
GEORGE WASHINGTON HUNSICKER.

"Cocaine and the erythroxylon coca plant."
ARTHUR BACON JONES.

"Analysis and utilization of mine water."
RICHARD LESLIE OGDEN.

"The isolation of metallic manganese."
STEPHEN COLLINS POTTS.

FOR THE DEGREE OF B.S.
(IN ARCHITECTURE.)

"Design for an Alumni Hall for Lehigh University."
WILLIAM ARTHUR PAYNE.

"Design for a Presbyterian church at Summit Hill, Pa."
HERMAN SCHNEIDER.

UNIVERSITY DAY.

This day is the last of the academic year, and falls in 1895 on the third Wednesday in June. On this day orations are delivered by members of the graduating class, and degrees are conferred.

EXERCISES ON JUNE 20, 1894.

Reading of Scripture and Prayer by the Rev. Elwood Worcester, Ph.D., Chaplain of the University.

Salutatory Oration.—"Energy versus Fate."
REZEAU BLANCHARD BROWN.

Oration.—"Louis Kossuth."
WELDON BURRIS WOODEN.

Oration.—"The Progress of Engineering."
WALTER CHRISTIAN SWARTZ.

Oration.—"William the First, Emperor of Germany."
WILLIAM A. ALLGAIER.

Oration.—"The Poetry of Architecture."
WILLIAM ARTHUR PAYNE.

Oration.—"Remember the Alamo."
BARRY HOLME JONES.

Oration.—"Americanism."
*ELWOOD ARISTIDES GRISSINGER.

Valedictory Oration.
JULIUS LEDERER NEUFELD.

Award of the Wilbur Scholarship to
WARREN JOSHUA BIEBER,
of Bethlehem, first in rank in the Sophomore Class; with honorable mention of LEWIS BENJAMIN DAVENPORT, of Baltimore, Md.

The Wilbur Prizes were awarded as follows:

Freshman Class, Mathematics, to
AMBROSE EVERETT YOHN, of Saxton.
GILBERT CASE WHITE, of Richmond, Va.

Freshman Class, French, to
WALTER EVERETTE BROWN, of Stamford, Conn.

Freshman Class, German, to
CARL PIVANY NACHOD, of Philadelphia.

Freshman Class, Themes, to
THOMAS HALLY BISSELL, of Buffalo, N. Y.

Freshman Class, Rhetoric, to
ROBERT COLLYER NOERR, of Washington, D. C.

Freshman Class, Freehand Drawing, to
ERLE REITER HANNUM, of Pottsville.

Freshman Class, General Chemistry, to
OWEN GRAY MACKNIGHT, of Plains.

* Excused from speaking.

The following Degrees were conferred:

M. S.

HERMAN EUGENE KIEFER, A.C.

B. A.

WILLIAM SPENCER MERRILL.

C. E.

LAWRENCE CALVIN BRINK,
EMOTT DAVIS BUEL,
JAMES LINDSEY BURLEY,
ALDEN BROWN DIVEN,
WALTER SEWELL DUNSCOMB,
THADDEUS PERCIVAL ELMORE,
JAMES DU BOSE FERGUSON,
ROBERT FERRIDAY,
WILLIAM McCLEERY HALL,
ANTON YOST HESSE,
FOSTER HAVEN HILLIARD,
RICHARD WARREN KNIGHT,
CLAUDE AVERETT LANGDON,
HARRY DONALDSON LEOPOLD,
CARL WILLIAM FREDERICK NEUFFER,
JEREMIAH FRANCIS O'HEARN,
EDGAR EARNEST SEYFERT,
JACOB DANIEL VON MAUR,
AUBREY WEYMOUTH,
THOMAS WILLIAM WILSON,
WELDON BURRIS WOODEN.

M. E.

IRVIN ISAAC BEINHOWER,
THOMAS JOSEPH BRAY, JR.,
REZEAU BLANCHARD BROWN,
FRANK WIESEMAN GLADING,
BAYARD GUTHRIE,
MATTHIAS HARRY HOLZ,
ALFRED A. HOWITZ,

GEORGE CASS HUTCHINSON,
WILLIAM HARRISON KAVANAUGH,
JAMES EDWIN LITTLE,
CLARENCE OLIVER LUCKENBACH,
JOHN VAN SICKLE MARTENIS,
FRANK WILLIAM ROLLER,
BENJAMIN FERDINAND SCHOMBERG,
WALTER CHRISTIAN SWARTZ,
ORSON WILLIAM TRUEWORTHY.

B. S.

(IN METALLURGY.)

WILLIAM A. ALLGAIER,
BARRY HOLME JONES,
MATTHEW McCLUNG, JR.,
JOSEPH OTTO MATHEWSON, JR.,
GODWIN ORDWAY,
WILLIAM VAUGHAN PETTIT, JR.,
CHARLES HAMILTON THOMPSON.

B. S.

(IN MINING.)

GEORGE WASHINGTON SCOTT BATON,
CHARLES BEECHER RUTTER,
RUEL CHAFFEE WARRINER.

E. E.

WILLIAM CONKLIN ANDERSON,
THEODORE GWATHMEY EMPIE,
FRANK FAUST,
JOHN JACOB FRANK,
LUTHER L. GADD,
ELWOOD ARISTIDES GRISSINGER,
FLETCHER DICKERMAN HALLOCK,
ARTHUR WILLISTON HENSHAW,
WILLIAM EMLEY HOLCOMBE,
JOHN DOUGLAS McPHERSON, JR.,
CHARLES ASHER MOORE,

JULIUS LEDERER NEUFELD,
CHARLES ATWOOD NEWBAKER,
THOMAS CHARLES RODERICK,
GEORGE ELWOOD SHEPHERD,
CHARLES ELDER SHIPLEY,
FREDERICK GEORGE SYKES,
PHILIP HENRY TROUT, JR.,
CLARENCE PORTER TURNER,
CHARLES W. UNDERWOOD,
EDWARD OLMSTEAD WARNER.

A. C.

WILLIAM COLWELL CARNELL,
MILTON BRAYTON GRAFF,
GEORGE WASHINGTON HUNSICKER,
ARTHUR BACON JONES,
RICHARD LESLIE OGDEN,
STEPHEN COLLINS POTTS.

B. S.

(IN ARCHITECTURE.)

WILLIAM ARTHUR PAYNE,
HERMAN SCHNEIDER.

THE WILBUR SCHOLARSHIP.

This Scholarship was founded in 1872 by E. P. Wilbur, Esq., of South Bethlehem, and is the sum of $200 awarded annually to the student in the Sophomore Class having the best record.

THE ALUMNI SCHOLARSHIP.

The Alumni Association of the University has established a Scholarship of the value of $250 per annum, subject to the following conditions:

1. That the Scholarship shall only be awarded to a student in need of it.

2. That the Scholarship shall not apply to the first year of any student's course; he must without this aid have

gone through one year, and must be prepared to start the second year free from all conditions.

3. That the Scholarship shall not be continued to a student who shall at any time during his course carry any condition over eight weeks beyond the date of the examination in which he failed.

Subject only to the above conditions the disposal of the fund shall until otherwise directed be in the hands of the President of the University.

THE HENRY S. HAINES MEMORIAL SCHOLARSHIP.

Mrs. Henry S. Haines, of Savannah, Ga., has established a scholarship of the annual value of $200, which is to be devoted to the support at the Lehigh University, throughout his scholastic career, of one student in the School of Mechanical Engineering; the selection to be made by Mrs. Haines herself during her life-time.

WILBUR PRIZES.

By the generosity of E. P. Wilbur, Esq., a fund has been established, yielding an annual income of $100, for distribution in prizes as the Faculty shall determine.

ALUMNI PRIZES FOR ORATORY.

The "Alumni Association of the Lehigh University" has established an annual sum of Fifty Dollars, to be distributed as prizes for excellence in Oratory, subject to the following

REGULATIONS.

1. The Contest shall be held on the 22d day of February, or on the day designated by the University to commemorate the birthday of Washington.

2. There shall be a first prize of $25, a second of $15, and a third of $10.

3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.

4. Subjects for the oration shall be announced at the beginning of the first term of every year, and upon one of these each competitor shall write an oration not to exceed eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do —should they be sufficient in number—the best six shall be chosen, and their envelopes opened. The others shall be returned to the address given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors whose orations shall have been approved, and the awards shall be made by a majority of these judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

At the last contest on February 22, 1893, the competitors were as follows:

Arthur Stebbins Clift, of Croton Falls, N. Y.
Walter Ferris, of Wilmington, Del.
Warren Byron Keim, of Reading.
William Allen Lambert, of Hellertown.
Fayette Avery McKenzie, of Montrose.
William Warr, of Philadelphia.

The First Prize was awarded to William Warr; the Second, to Arthur Stebbins Clift; the Third, to Fayette Avery McKenzie.

The next contest will take place February 22, 1895.

ENTRANCE EXAMINATION PAPERS.

Used for Examination in 1894.

[Requests for other examination papers than those herein printed can not be granted.]

I.—ENGLISH.

I.

1. Analyze the following sentence:

After a careful survey of the whole ground, our belief is that no such persons as Professor Teufelsdröckh or Counsellor Heuschrecke ever existed; that the six Paper-bags, with their China-ink inscriptions and multifarious contents, are a mere figment of the brain; that the present Editor is the only person who has ever written upon the Philosophy of Clothes; and that the *Sartor Resartus* is the only treatise that has yet appeared upon that subject;—in short, that the whole account of the origin of the work before us, which the supposed Editor relates with so much gravity, and of which we have given a brief extract, is, in plain English, a *hum.*

2. Distinguish between the uses of the Interrogative Pronouns *who*, *which*, and *what;* and illustrate by sentences.

3. What is a *collective noun?* What number of the verb is used with such a noun?

4. Give the principal parts of the following verbs: *swim*, *dive*, *awake*, *seethe*, *reave.*

5. When is the *colon* used in punctuation?

II.

1. Distinguish between *grammar* and *rhetoric.*

2. Define the following terms: *Purity*, *Barbarism*, *Figure of Speech*, *Solecism*, *Antithesis.*

3. Write a *Simile*, a *Personification*, a *Synecdoche*, a *Hyperbole.*

4. Write an essay of four hundred words on one of the following subjects:

The Plot against Cæsar (Shakespeare's *Julius Cæsar*).
Christian's Fight with Apollyon.
The Character of Ivanhoe.

This question counts as four on a scale of ten.

II.—GEOGRAPHY.

Outline maps of the Western part of the United States and of Northern Europe, were furnished to each applicant and he was required to draw the boundaries of countries, provinces, states, and territories, and name them, to place and name the capital or chief city of each, and the principal rivers and mountain systems.

III.—UNITED STATES HISTORY.

1. *a.* What was the London company?
   b. What grant of territory did it receive?
2. *a.* When and by whom was New York settled?
   b. What changes of government in New York from the time of its settlement until the Revolution?
3. *a.* What war finally settled the question of supremacy on the American continent between the English and French?
   b. What was the last important battle of this war?
   c. Who commanded each army?
4. *a.* What two campaigns in 1777?
   b. What was the result of each?
5. *a.* What four campaigns in the eastern part of the United States in 1862?
   b. Name the principal events in each?
6. *a.* What dispute was ended by the treaty of Washington, in 1871?
   b. What were the provisions of the treaty, and how were they carried out?

CONSTITUTION.

1. *a.* In what body are vested the legislative powers of the United States Government?
   b. Into what two parts is this body divided?

c. What are the qualifications for membership in each?

2. *a.* How are members of each of the two branches of the national legislature appointed among the several states?

   b. How is the presiding officer of each branch chosen?

3. What are the powers of the states under the Constitution?

4. What mention is made of freedom in *speech*, *religion*, and press?

IV.—ARITHMETIC.

1. Find the highest common divisor of 11308, 1200, and 1702, giving reason for each step of the work.

2. Find interest, discount, and bank discount on $40 from May 12th, 1876, to October 14th, 1877, @ 6 per cent.

3. How may a herd of 700 cattle be made up, of cattle worth $40 and $70 a head, that the average value of the herd may be $50 a head?

4. Reduce 9 gal. 3 qts. 2 gills to litres.

5. Bought a horse for 25 per cent. more than its true value, and sold it for 25 per cent. less. Find loss per cent.

6. Define:

   (*a*) Arithmetic, number, integer, repetend, fraction. Describe the method of reducing compound denominate numbers to integers of lower denominations, and the converse process.

   (*b*) How many rods in a mile; cubic inches in one bushel; cubic inches in a gallon; cubic feet in a cord; square rods in an acre; square miles in a township?

   (*c*) Define: Interest, duty ad valorem, annuity, ratio, and compound proportion.

V.—GEOMETRY.

1. In every parallelogram the opposite sides are equal and the opposite angles are equal, and conversely.

2. Two parallels intercept equal arcs on a circumference.

3. If through any fixed point in the plane of a circle a straight line is drawn intersecting the circumference, the product of the distances of the fixed point to the two points of intersection is constant.
4. Divide a straight line in extreme and mean ratio (with proof).
5. If the three sides of a right triangle be taken as the homologous sides of three similar polygons constructed upon them, then will the polygon constructed upon the hypothenuse be equivalent to the sum of the polygons constructed upon the other two sides.
6. Inscribe the regular decagon, and find length of one side in terms of the radius.
7. The circumference of a circle is the limit to which the perimeters of the regular inscribed and circumscribed polygons approach when the number of their sides is increased indefinitely; and the area of the circle is the limit of the area of these polygons.
8. Two diedral angles are in the same ratio as their plane angles (both when the plane angles are commensurable and when they are incommensurable).
9. (*a*) From a point without a plane one perpendicular can be drawn to the plane, and but one.
   (*b*) From a point within a plane one perpendicular can be erected to the plane, and but one.
10. Define: Plane, geometrical figure, geometry, centre of symmetry, rhomboid, sector, regular polygon.
    (*b*) Define the terms: Ratio, mean proportional, "reductio ad absurdum," ratio of similitude. When is one quantity said to be proportional to another? When is a line said to be harmonically divided?
    (*c*) Define: Limit, maximum, locus, polyedral and diedral angles. When are two figures said to be "equal by symmetry"?

VI.—ALGEBRA.

1. (*a*) Define an equation; homogeneous equation; simultaneous equations; root of an equation; quadratic equation.

   (*b*) Define exponents and coëfficients as symbols of operation (all cases; positive, negative, integral, and fractional).

   (*c*) Describe operations indicated by $(a-y)\{\sqrt{(2bx)}+x^2\}+\sqrt{\{(a-x)(b+y)\}}$. Express the following in symbols: The sum of a times the the square root of the difference of three times b and the second power of x, and x times the third root of the sum of three times x and the second power of y.

2. (*a*) Define a rule; a formula; a radical quantity, and give the different kinds.

   (*b*) Define a fraction; also the various kinds, proper, improper, etc.

   (*c*) Give rules for freeing a fraction of negative exponents, both when its terms are monomial and when they are polynomial.

3. Prove that $a-b$ is a factor of $a^n - b^n$ when n is integral, and show what this statement becomes when b is negative.

4. Expand $(x^2-y)^{\frac{1}{2}}$ and $\dfrac{1}{x^{-\frac{1}{2}}-y^{\frac{1}{3}}}$ each to five terms by the binomial formula.

5. Reduce

$$\frac{x}{\sqrt[2]{-y^2}},\ \frac{x}{\sqrt[3]{(-y)^2}},\ \frac{x}{\sqrt[4]{-y^3}},\ \frac{5}{\sqrt[3]{4}+\sqrt[4]{3}},\ \text{and}\ \frac{5}{\sqrt[3]{4}+\sqrt[5]{3}}$$

   to forms having rational denominators.

6. Produce the formulæ showing relations of parts in a geometrical progression.

7. (*a*) $\dfrac{2x-1}{\sqrt{2x}-1}+1=\dfrac{\sqrt{2x}-1}{2}+2$. Solve and verify.

(*b*) If it takes a pieces of one kind of money to make a dollar and b pieces of another kind to make a dollar, how many of each must be taken in order that c pieces may be worth a dollar?

8. (*a*) At what time between 4 and 5 o'clock are the hands of a clock at right angles?

(*b*) A man sold two horses for $205 each: on one he gained 25% and on the other he lost 25%. Required the whole gain or loss.

9. (*a*)
$$x + y = 10,$$
$$\sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = \frac{5}{2}.$$

(*b*)
$$x^2 - 4y^2 = 9,$$
$$2y^2 + xy = 3.$$
Find x and y.

VII.—PHYSICS.

1. Define: (*a*) Dynamics.
(*b*) Kinetic unit of force.
(*c*) Difference of potential.
(*d*) E. M. F. of polarization in a cell.
(*e*) Watt.
(*f*) Resonance.
(*g*) Evaporation.
(*h*) Thermodynamics.
(*i*) Chromatic aberration.
(*j*) Conjugate foci.

2. Describe the Fahrenheit hydrometer and tell how it is used.

3. Explain the action of the electrophorus.

4. How would you find the latent heat of water experimentally?

5. How can the principal focal distance of a convex lens be found?

6. A body weighs 1115 lbs. in water, and 875 lbs. in another liquid whose specific gravity is 3. Find (*a*) its weight in air, (*b*) its volume, (*c*) its specific gravity.

7. A current of 10 amperes is sent through a resistance of 44.76 ohms. What electrical horse-power is required, and how many calories are generated in this circuit in ten minutes?

8. If a wire 1 m. long, weighing 1 g., has a resistance of 1.85 ohms, what must be the weight of 20 m. of wire of the same material having a resistance of 14.1 ohms?

9. At the ends of a lever 9 feet long are suspended 8 lbs. and 10 lbs. The lever is in equilibrium. Where is the fulcrum and how far must it be moved so that if 1 lb. is added to each of the weights they still balance?

10. Into a copper vessel weighing 50 g. and holding 500 g. of water at 10° c., was dropped a piece of lead at 100° c., and weighing 20 g. What was the resulting temperature? Sp. ht. of copper = .0952. Sp. ht. of lead = .0314.

11. With what velocity must a seven-pound ball strike an iron target weighing 70 lbs., to raise its temperature 17.7° F.? All the heat generated is to be applied to the target. Sp. ht. of iron = .1138.

12. At what distance must a rod 12 inches long be placed from a light so that it will cast a shadow 36 inches long on a screen 10 feet from the light?

VIII.—PHYSICAL GEOGRAPHY.

1. Give the causes of the change of seasons.
2. Give the causes of ocean waves, tides, and currents.
3. Describe and give causes of constant, periodical, and variable winds.
4. Define and tell how rain, fog, mist, clouds, dew, and snow are formed.
5. What is a rainbow and how formed?

6. What are the principal food-producing plants of the United States?

7. How are the United States divided in regard to distribution and quantity of rain.

IX.—LATIN.

I AND II. GRAMMAR AND CÆSAR.

Translate:

Cognito Cæsaris adventu, Ariovistus legatos ad eum mittit: quod antea de conloquio postulasset, id per se fieri licere, quoniam propius accessisset, seque id sine periculo facere posse existimare. Non respuit condicionem Cæsar, jamque eum ad sanitatem reverti arbitrabatur, cum id, quod antea petenti denegasset, ultro polliceretur; magnamque in spem veniebat, pro suis tantis populique Romani in eum beneficiis, cognitis suis postulatis, fore uti pertinacia desisteret. Dies conloquio dictus est ex eo die quintus. Interim saepe ultro citroque cum legati inter eos mitterentur, Ariovistus postulavit, ne quem peditem ad conloquium Cæsar adduceret: vereri se, ne per insidias ab eo circumveniretur; uterque cum equitatu veniret; alia ratione sese non esse venturum.—*De Bello Gallico I.* 42.

Decline *adventu*, *spem*, *legatos*, and give a scheme of the case endings of the five declensions. Decline *id*, *se*, *petenti*, *alia*, complete in all genders and both numbers. Compare *propius*. Explain the syntax of *postulasset*, *polliceretur*, *mitterentur*, *adduceret*, *venturum*. Give the rules for the use of verbs in the Indirect Discourse. Give the syntax of *adventu*, *pertinacia*, *conloquio*. Why is *spem* acc. and not abl.? Explain the form *postulasset*. Give the principal parts of *accessisset*, *arbitrabatur*, *polliceretur*, *fore*. Give the cardinal, the distributive and the adverb answering to *quintus*.

Translate:

His de rebus Cæsar certior factus, et infirmitatem Gallorum veritus, quod sunt in consiliis capiendis mobiles et novis plerumque rebus student, nihil his committendum

existimavit. Est enim hoc Gallicae consuetudinis, uti et viatores etiam invitos consistere cogant, et quid quisque eorum de quaque re audierit aut cognoverit quaerant; et mercatores in oppidis vulgus circumsistat, quibusque ex regionibus veniant quasque ibi res cognoverint pronuntiare cogant. His rebus atque auditionibus permoti de summis saepe rebus consilia ineunt, quorum eos in vestigio paenitere necesse est, cum incertis rumoribus serviant, et plerique ad voluntatem eorum ficta respondeant.

—*De Bello Gallico IV.* 5.

Why is *sunt* used and not the subj.? How does the construction *consiliis capiendis* differ from the English idiom? Give syntax of *consuetudinis*, *uti . . . . cogant*, *veniant*, *rumoribus*. Give synopsis of *cogant* in the First Person. Compare *mobilis*, *novus*, *summis*. Decline *vulgus*.

III. Cicero.

Translate:

1. Sed cur tam diu de uno hoste loquimur, et de hoste qui jam fatetur se esse hostem, et quem, quia (quod semper volui) murus interest, non timeo: de eis qui dissimulant, qui Romae remanent, qui nobiscum sunt, nihil dicimus? Quos quidem ego, si ullo modo fieri possit, non tam ulcisci studeo quam sanare sibi ipsos, placare rei publicae, neque id qua re fieri non possit, si me audire volent, intellego. Exponam enim vobis, Quirites, ex quibus generibus hominum istae copiae comparentur, deinde singulis medicinam consili atque orationis meae, si quam potero, adferam.

—*Cat. II*, 17.

Where and to whom was this oration delivered? Give syntax of *sibi*.

2. Qua re videant ne sit periniquum et non ferundum, illorum auctoritatem de Cn. Pompei dignitate a vobis comprobatam semper esse, vestrum ab illis de eodem homine judicium populique Romani auctoritatem improbari;

praesertim cum jam suo jure populus Romanus in hoc homine suam auctoritatem vel contra omnes qui dissentiunt possit defendere, propterea quod, isdem istis reclamantibus, vos unum illum ex omnibus delegistis quem bello praedonum praeponeretis.—*Manil. Law. XXII.*

IV. Vergil.

Translate:

1. Talia jactabam, et furiata mente ferebar:
cum mihi se, non ante oculis tam clara, videndam
obtulit et pura per noctem in luce refulsit
alma parens, confessa deam, qualisque videri
caelicolis et quanta solet, dextraque prehensum
continuit, roseoque haec insuper addidit ore:
'Nate, quis indomitas tantus dolor excitat iras?'
Aen. II. 588–594.

Syntax of *deam.* With what words is *ore* easily confounded? Scan lines 3 and 4, marking the feet and caesuras.

2. 'Phoebe, graves Trojae semper miserate labores,
Dardana qui Paridis direxti tela manusque
corpus in Aeacidae, magnas obeuntia terras
tot maria intravi duce te, penitusque repostas
Massylum gentes praetentaque Syrtibus arva,
jam tandem Italiae fugientis prendimus oras;
hac Trojana tenus fuerit Fortuna secuta.
Aen. VI. 56–62.

Give principal parts of *miserati*, *direxti.* Where were the *Syrtes?* Why does the poet use the word *fugientis* in this connection?

V. Sight Reading.

Translate:

Cæsar in eam spem venerat, se sine pugnae et sine volnere suorum rem conficere posse, quod re frumentaria ad-

versarios interclusisset. Cur etiam secundo proelio aliquos ex suis amitteret? cur vulnerari pateretur optime de se meritos milites? cur denique fortunam periclitaretur? praesertim cum non minus esset imperatoris consilio superare quam gladio. Movebatur etiam misericordia civium, quos interficiendos videbat; quibus salvis atque incolumibus rem obtinere malebat.

VI. Composition.

Translate into Latin:

But the enemy, as soon as they had seen our cavalry, the number of whom was five thousand, sent scouts (*speculator*) ahead to see where our camp was. When they saw that it was strong and that it could not easily be captured (*expugnare*), having posted guards they passed the night there. If they had not done so, they might have prevented us from the march, because the legion was too weak to set out if the enemy were near.

VII. History.

1. Give the dates, main events and results of the First Punic War.

2. In what battle did Hasdrubal fall? What battle closed the Second Punic War, with date and the commanders of the opposing armies?

3. Give an account of the Social War.

4. Give the life of Cicero.

5. Who composed the two triumvirates, and how were they brought to an end?

X.—GREEK.

I. Grammar.

1. Write correctly and give principle: *τέτριβται, πέπειθμαι, συνγενής, νύκτ'ὅλην, ἐξλέγω, οὐ οἶδα, ἐσταλσθε.*

2. Write contracted form of *γένεα, φοβέεσθε, τιμάῃ, δηλόητε, δηλόειν.*

3. Accent: *συνεχε, συνειχον, λειπων, λιπων, ἐτιμησας, τιμησας, ἠλθε, ἐλθε, παιδες τινες, ἀνδρες τινες, εἰ τις.*

4. Write the Acc. Sing. and Dat. Plur. of *ἀνήρ, γυνή, ἡδύς, πόλις, ὄρνις, λύων, χείρ, βασιλεύς.*

5. Compare *ἐχθρός, σώφρων, μέγας.* Form adverbs and compare, from *δίκαιος, ταχύς.*

6. Give a synopsis of the 2nd Aor. Pass. of *φαίνω*; the Aor. Act. of *δίδωμι*; Perf. Act. of *ἵστημι.*

7. Give principal parts of *φέρω, αἱρέω, γίγνομαι, στέλλω.*

8. Write the uncontracted and contracted forms of the Opt. Pres. Act. of *τιμάω.*

9. Write the Perfect and Pluperfect in full of *οἶδα.*

10. Distinguish between *βούλευσαι, βουλεῦσαι, βουλεύσαι.*

II. Xenophon.

1. Translate: *φίλους γε μὴν ὁσους ποιήσαιτο καὶ εὔνους γνοίη ὄντας καὶ ἱκανοὺς κρίνειε συνεργοὺς εἶναι ὁ, τι τυγχάνοι βουλόμενος κατεργάζεσθαι, ὁμολογεῖται πρὸς πάντων κράτιστος δὴ γενέσθαι θεραπεύειν. καὶ γὰρ αὐτὸ τοῦτο οὗπερ αὐτὸς ἕνεκα φίλων οἴετο δεῖσθαι, ὡς συνεργοὺς ἔχοι, καὶ αὐτὸς ἐπειρᾶτο συνεργὸς τοῖς φίλοις κράτιστος εἶναι τούτου ὅτου αἰσθάνοιτο ἕκαστον ἐπιθυμοῦντα.*

Explain construction of all optatives, infinitives, participles; also of *οὗπερ, φίλων, τούτου, ὅτου.*

Of whom was this said? On what occasion?

2. Translate: *ἐτύγχανον λέγων ὅτι πολλαὶ καὶ καλαὶ ἐλπίδες ἡμῖν εἶεν σωτηρίας. Πρῶτον μὲν γὰρ ἡμεῖς μὲν ἐμπεδοῦμεν τοὺς τῶν θεῶν ὅρκους, οἱ δὲ πολέμιοι ἐπιωρκήκασί τε καὶ τὰς σπονδὰς παρὰ τοὺς ὅρκους λελύκασιν. οὕτω δ' ἐχόντων, εἰκὸς τοῖς μὲν πολεμίοις ἐναντίους εἶναι τοὺς θεούς, ἡμῖν δὲ συμμάχους, οἵπερ ἱκανοί εἰσι καὶ τοὺς μεγάλους ταχὺ μικροὺς ποιεῖν καὶ τοὺς μικροὺς κἂν ἐν δεινοῖς ὦσι σώζειν εὐπετῶς, ὅταν βούλωνται.*

Explain construction of *λέγων, ἡμῖν, εἶεν, ἐχόντων, ὦσι.*

What is the Latin equivalent for the expression *οὕτω δ' ἐχόντων*?

Analyze the form *κἂν.* In line 2, why two *μεν*s?

By whom was this said? To whom? When? For what purpose?

3. Translate (at sight): "Νῦν τοίνυν," ἔφη ὁ Ξενοφῶν, "πάρειμι καὶ ἐγὼ καὶ οὗτος Φρυνίσκος εἰς τῶν στρατηγῶν καὶ Πολυκράτης εἰς τῶν λοχαγῶν, καὶ ἔξω εἰσὶν ἀπὸ τῶν στρατηγῶν ὁ πιστότατος ἑκάστῳ πλὴν Νέωνος τοῦ Λακωνικοῦ. εἰ οὖν βούλει πιστοτέραν εἶναι τὴν πρᾶξιν, καὶ ἐκείνους κάλεσαι. τὰ δὲ ὅπλα σὺ ἐλθὼν εἰπέ, ὦ Πολύκρατες, ὅτι ἐγὼ κελεύω καταλιπεῖν καὶ αὐτὸς ἐκεῖ καταλιπὼν τὴν μάχαιραν εἰσιθι."

III. Homer.

1. *Translate:*

Ζεῦ κύδιστε μέγιστε, κελαινεφές, αἰθέρι ναίων,
μὴ πρὶν ἐπ' ἠέλιον δῦναι, καὶ ἐπὶ κνέφας ἐλθεῖν,
πρίν με κατὰ πρηνὲς βαλέειν Πριάμοιο μέλαθρον
αἰθαλόεν, πρῆσαι δὲ πυρὸς δηίοιο θύρετρα,
Ἕκτόρεον δὲ χιτῶνα περὶ στήθεσσι δαΐξαι
χαλκῷ ῥωγαλέον· πολέες δ' ἀμφ' αὐτὸν ἑταῖροι
πρηνέες ἐν κονίῃσιν ὀδάξ λαζοίατο γαῖαν.

Give Attic forms of words underlined.

Explain construction of *ἐλθεῖν*, *βαλέειν*, *λαζοίατο* (where found?).

1. *Translate:*

ἦ ῥα καὶ ἀμπεπαλὼν προΐει δολιχόσκιον ἔγχος,
καὶ βάλε Πριαμίδαο κατ' ἀσπίδα παντόσ' ἐίσην.
διὰ μὲν ἀσπίδος ἦλθε φαείνης ὄβριμον ἔγχος,
καὶ διὰ θώρηκος πολυδαιδάλου ἠρήρειστο·
ἀντικρὺ δὲ παραὶ λαπάρην διάμησε χιτῶνα
ἔγχος· ὁ δ' ἐκλίνθη καὶ ἀλεύατο κῆρα μέλαιναν.
Ἀτρεΐδης δὲ ἐρυσσάμενος ξίφος ἀργυρόηλον
πλῆξεν ἀνασχόμενος κόρυθος φάλον· ἀμφὶ δ' ἄρ' αὐτῷ
τριχθά τε καὶ τετραχθὰ διατρυφὲν ἔκπεσε χειρός.

Write feet and quantities of first five lines.

On what occasion did this fight take place? Who were the combatants? What did they fight about? What was the result.

IV. History.

1. Give an account of the Athenian State before Solon.
2. Describe the expedition of Xerxes.
3. Give an account of the Sicilian expedition.
4. What can you say about Peisistratus? about Epaminondas?
5. Give an account of Demosthenes, and an estimate of his career.

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The number of graduates is 670, degrees having been conferred as follows:

Upon graduates of the School of General Literature: B. A., 38; B.S., 16; Ph.B., 7; M.A., 9.

Upon graduates of the School of Technology: C.E., 259; M.E., 130; B.M., 19; B.S. (in Mining and Metallurgy), 62; E.M., 58; E.E., 47; A.C., 76; B.S. (in Architecture), 4; M.S., 2; Ph.D., 1.

Of these, 1 has taken the degrees of B.A. and B.M.; 9 of B.A. and M.A.; 2 of B.S. and C.E.; 1 of B.S. and A.C.; 11 of B.M. and E.M.; 29 of B.S. and E.M.; 1 of B.M., E.M., and A.C.; 1 of B.S., E.M., and C.E.; 1 of C.E. and E.M.; 2 of A.C. and E.M.; 1 of A.C. and M.S.; 1 of A.C., M.S., and Ph.D. 641 graduates are still living.

* Deceased.

The following have been awarded certificates for the

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Elmer Ellsworth Boyer, '85, Foreman Arc Testing Department, Thomson-Houston Electric Co., Lynn, Mass.

Albert Brodhead, '88, 121 S. Centre Street, Bethlehem, Pa.

Edward Conner, '86, Philadelphia, Pa.

William Fairchild Dean, '88, Thomson-Houston Electric Co., 91 Warren Street, Lynn, Mass.

Horace Musser Engle, '85, President Montor Steam Generator Manufacturing Co., Roanoke, Va.

Herman Frauenthal, '88, Wilkes-Barre, Pa.

Walter George Fuller, '87, Brattleboro, Vermont.

John Wesley Hackney, '87, Graphic Process Co., Pleasantville, N. J.

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William Hoopes, '86, Superintendent Edison Electric Co.'s Station, West Chester, Pa.

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OF

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SOUTH BETHLEHEM, PA.

1895-1896.

FOUNDED BY ASA PACKER.

BETHLEHEM, PA.:
TIMES PUBLISHING COMPANY.
1896.

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1895.

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SEPTEMBER.

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6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	...	...	...
...	...	...	...	...	...	...

OCTOBER.

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NOVEMBER.

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DECEMBER.

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1897.

JANUARY.

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FEBRUARY.

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MARCH.

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APRIL.

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MAY.

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JUNE.

S	M	T	W	T	F	S
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CALENDAR.

1895.	1895-1896.	
Sept. 7, 9, 10,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 11,	Wednesday, . .	First Term begins.
Oct. 10,	Thursday, . .	Founder's Day.
Nov. 28,	Thursday, . .	Thanksgiving Day.
Dec. 18,	Wednesday, .	First Term ends.
1896.		
Jan. 6, 7, 8,	Monday, Tuesday, and Wednesday,	Examinations for Admission to Second Term.
Jan. 8,	Wednesday, .	Second Term begins.
Jan. 18,	Saturday, . .	Junior Prize Orations due.
Feb. 19,	Wednesday, .	Ash Wednesday.
Feb. 22,	Saturday, . .	Washington's Birthday.
April 2,	Thursday, . .	Easter Holidays begin.
April 7,	Tuesday, 8¼ A.M. .	Easter Holidays end.
May 25,	Monday, . .	University Day Orations due.
May 27,	Wednesday, . .	Theses of Seniors due.
May 27,	Wednesday, .	Senior Examinations begin.
June 8,	Monday, . . .	Annual Examinations begin.
June 14,	Sunday, . .	Baccalaureate Sermon.
June 15,	Monday, . . .	Class Day.
June 17,	Wednesday, .	University Day.
Jun. 18, 19, 20,	Thursday, Friday, and Saturday,	Examinations for Admission.
1896.	**1896-1897.**	
Sept. 19, 21, 22,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 23,	Wednesday, . .	First Term begins.
Oct. 8,	Thursday, . .	Founder's Day.
Nov. 26,	Thursday, . .	Thanksgiving Day.
Dec. 23,	Wednesday, .	Christmas Holidays begin.
1897.		
Jan. 4,	Monday, 8¼ A.M. .	Christmas Holidays end.
Jan. 29,	Friday, . .	First Term ends.
Feb. 1, 2, 3,	Monday, Tuesday, and Wednesday,	Examinations for Admission to Second Term.
Feb. 4,	Thursday, . .	Second Term begins.
June 16,	Wednesday, .	University Day.

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148 Church Street, Bethlehem.

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Cataloguing Clerk,
WILSON F. STAUFFER.

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THE LEHIGH UNIVERSITY.

ORIGIN.

The Hon. Asa Packer, of Mauch Chunk, during the year 1865, appropriated the sum of $500,000, to which he added one hundred and fifteen acres of land in South Bethlehem, to establish an educational institution in the rich and beautiful Valley of the Lehigh. On this foundation rose The Lehigh University, incorporated by the Legislature of Pennsylvania in 1866. In addition to these gifts, made during his lifetime, Judge Packer by his last will secured to the University an endowment of $1,500,000, and to the University Library one of $500,000.

DESIGN.

The original object of Judge Packer was to afford the young men of the Lehigh Valley a complete education, technical, literary, and scientific, for those professions represented in the development of the peculiar resources of the surrounding region. In furtherance of this purpose instruction is liberally provided in Civil, Mechanical, Mining, and Electrical Engineering, Chemistry, Metallurgy, Architecture, and in all needful collateral studies. A School of General Literature is also established and thoroughly equipped, with three departments, called respectively the Classical, the Latin-Scientific, and that of Science and Letters.

TUITION.

The following charges are made for tuition:

For students in the Technical courses, $100 per annum: $60 for the first term, $40 for the second term; for stu-

dents in the school of General Literature, $60 per annum: $40 for the first term, $20 for the second term.

These fees include all tuition, with the use of the Library and Gymnasium, but the student is charged for materials and apparatus consumed in the Laboratories.

The Trustees have placed at the disposal of the Faculty a limited number of scholarships, to be awarded to applicants of good moral character who shall pass the entrance examinations creditably, and who for other cause shall be regarded as worthy by the Faculty.

Applications for these free scholarships should be made to the President of the University, who will furnish all needed information concerning the regulations which govern their bestowal.

All fees for tuition are payable to the Treasurer of the University in two instalments, as above. The first instalment is to be paid to the treasurer of the University on or before October 10; the second on or before January 20.

Students who fail to pay tuition fees when due will be notified by the President that their attendance at college exercises must be discontinued until payment is made.

Every candidate for a degree is required to pay a graduation fee of $10, before the degree is conferred.

PUBLIC WORSHIP.

Prayers are held in the Packer Memorial Church of the University every morning and all students are required to be present.

Divine service is held every Sunday morning in the church. The service is according to the forms of the Protestant Episcopal Church, under whose auspices the University was placed by its Founder. Attendance is required of every student, except in case of those connected with other religious bodies, to whom the President will grant permission at the beginning of each term (if requested by the parent or guardian, or by the student himself if

he be 21 years of age) to attend during that term the place of worship of the body with which he is connected, where attendance on Sunday morning will be required.

SITE.

The situation of the institution is healthful and beautiful. The region is famous for its railway and manufacturing enterprises; it possesses some of the richest iron and coal mines in our land, and thus gives the students rare facilities for confirming the teachings of the recitation room by the observation of the eye.

The University buildings are about a half-mile from the depot, at the junction of the Lehigh Valley, the New Jersey Central, and the Reading (North Pennsylvania) Railroads. New York is ninety-two and Philadelphia fifty-eight miles distant.

BUILDINGS.

PACKER HALL,

named after the Founder, stands seven hundred feet back of Packer Avenue, at the base of the South Mountain. It is built of stone, and contains the lecture and recitation rooms of the departments of Philosophy, Greek, Latin, Modern Languages, English, History, and Mathematics; the lecture, recitation, and drawing rooms, and the collections of the departments of Civil, Mechanical, and Mining Engineering, and the museum of geology and natural history.

THE CHEMICAL LABORATORY

is thoroughly fire-proof, is built of sandstone, and is 219 feet in length by 44 in width.

There are two principal stories and a basement. The upper floor is occupied by the quantitative and the qualitative chemical laboratories, the former accommodating 48 and the latter 84 students. These rooms are 22 feet in height, and are well lighted and ventilated. A laboratory for industrial chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a recitation room, a chemical museum, and laboratories for organic, physiological, agricultural, and sanitary chemistry.

In the basement is the large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis, also rooms containing the apparatus for several processes in industrial chemistry, the engine and air-pump for vacuum filtration, a store room, and the toilet.

A photographic laboratory is located in the third story of the central portion of the building.

THE METALLURGICAL LABORATORY

contains a lecture room, a blowpipe laboratory for class instruction in blowpipe analysis and in the practical determination of crystals and minerals, a museum for mineralogical and metallurgical collections, a mineralogical laboratory provided with a Fuess reflecting goniometer, a polariscope, a Groth's "universal apparat," and a Rosenbusch polarizing microscope, a dry laboratory provided with furnaces for solid fuel and for gas with natural draught and with blast, and a wet laboratory for ordinary analytical work. It is arranged for the instruction of classes in the courses of mineralogy, metallurgy, and blowpipe analysis of the regular curriculum, and to afford facilities to a limited number of advanced students for familiarizing themselves with the methods of measurement and research employed in mineralogy and metallurgy, and for conducting original investigations in these departments of science.

THE PHYSICAL LABORATORY.

This building is of stone, 235 feet in length, and 4 stories in height. The first or ground floor is devoted to electrical work, and forms the Senior Electrical Laboratory. It contains a large dynamo room, with the engine, dynamos, and motors, with all their appliances; battery, balance, calorimetric rooms and workshops. The eastern part of this story has been carefully arranged for delicate work. The use of iron has been avoided; the gas and steam mains and pipes, radiators, etc., are all of brass. In this section

are seven special rooms for investigations of the magnetic properties of iron and for original research. A hall over 200 feet in length can be darkened and utilized for long range work in testing lamps. Under this floor is the "cave" or even-temperature room, completely enclosed with solid stone masonry. On this and the other three floors are private laboratories, store and apparatus rooms, and offices for instructors.

The second story contains the Junior Electrical Laboratory, 56 by 44 feet; the Mechanical Laboratory, 60 by 44 feet, with tables for 80 students, the Library, a time room and two balance rooms, with floors resting on solid stone arches.

On the third floor is a public hall, 70 by 44 feet, for examinations; also the professor's lecture room, 40 by 44 feet, with private laboratories, etc.

On the fourth floor in the west wing are two recitation rooms for the instructors, 40 by 18 feet, and the Heat Laboratory, 44 feet square, with tables for 72 persons. On the east side is the Light Laboratory. This contains one room with tables for 40 persons, and 8 smaller dark rooms, each of which can be divided into two parts. Besides these are 4 photographic dark rooms, 8 by 28 feet feet, each with all the necessary equipments.

The tower, which is devoted to meteorological purposes, has two stories of one room each, 16 by 21 feet, with a vane room above. Besides these there are several small rooms for special purposes scattered among the four floors.

The tendency in the latest and best Physical Laboratories is towards a larger number of smaller rooms, rather than to a few large rooms. It will be seen from this description that the advantages of this plan have been gained by the many smaller rooms that exist, while for general work the larger halls are provided.

Three staircases, at the middle and the two ends of the building, afford ample means of entrance and egress.

THE SAYRE OBSERVATORY.

Near Brodhead Avenue is the Sayre Observatory, the gift of Robert H. Sayre, Esq., of South Bethlehem, containing an equatorial and a zenith telescope, transit instrument, and astronomical clock.

THE PACKER MEMORIAL CHURCH

is the munificent gift of Mrs. Mary Packer Cummings, daughter of the Founder of the University. It is one of the largest and most magnificent Churches in the State, richly furnished and handsomely appointed in every particular.

THE UNIVERSITY LIBRARY.

To the east of Packer Hall is the University Library, erected by the Founder in memory of Mrs. Lucy Packer Linderman, his daughter.

THE GYMNASIUM

is a handsome and spacious structure, built and equipped with the utmost thoroughness. It is furnished with the best patterns of gymnastic apparatus, besides Dr. Sargent's system of developing appliances. It is provided with hot and cold water; tub, sponge, and shower baths, and 389 clothes closets. Opportunities for recreation and amusement are provided in the bowling alleys. It is under the immediate care of a skilled and competent Director.

All students are required to undergo a physical examination before being allowed the use of the Gymnasium, and this examination will be repeated once each year during their stay at the University. The proper exercise is prescribed and is required of every student. These regulations are designed to promote the harmonious, symmetrical development of the individual student.

EXPENSES.

Books, materials, paper, pencils, materials used in the chemical laboratories, and drawing instruments are furnished by the student. Materials consumed in the chemical laboratories can be obtained from the University, their

value being covered by a deposit made at the opening of that term in which the laboratory work is to be done.

Rooms and board cannot be had in University buildings, but can readily be obtained in many private houses.

The following is an estimate of the necessary expenses for the collegiate year, clothing and traveling not included :

Tuition, ...	$100		$100
Board for 40 weeks, . . .	from 160	to	200
Room-rent, with fuel and lights .	40	"	80
Care of room and use of furniture, .	5	"	20
Washing and incidentals, ...	20	"	40
Books, stationery, etc., ...	25	"	50
Total, ...	$350	to	$490

(In the case of students in the School of General Literature, the totals will be $310 to $450.)

NOTE.—If clubs be formed the cost of board need not exceed $3.50 per week.

ADMISSION OF STUDENTS.

The Register is intended to give all necessary information concerning the admission of students. Application may be made to the President of the University if information is desired which is not given in the Register.

DATE OF EXAMINATIONS.

Examinations for admission to the University are held at the opening of each term, and also in June at the close of the academic year.

The examinations for 1896 will be on Monday, Tuesday, and Wednesday, January 6, 7, and 8, for admission to the second term; on Thursday, Friday, and Saturday, June 18, 19, and 20, and on Saturday, Monday, and Tuesday, September 19, 21, and 22, for admission to the first term. No other examinations for admission will be held, except for good cause, and all applicants *must* be in attendance at 9 o'clock on the morning of the first day.

The examinations are held in June and September in the following order:

First Day.—English, 9 A.M.; Arithmetic, 11 A.M.; Physics, 2 P.M.; Latin and Roman History, 2 P.M.

Second Day.—Geometry, 8.30 A.M.; Physical Geography, 11.30 A.M.; Geography, 3 P.M.; United States History, 4 P.M.

Third Day.—Algebra, 8.30 A.M.; Greek and Greek History, 2 P.M.

The schedules of examinations for applicants for admission to the Freshman Class at the beginning of the second term and to the Sophomore Class at the beginning of the first term may be obtained from the Secretary of the Faculty. Examinations at other than the appointed times can not be

granted without great inconvenience, and candidates so applying will be required to pay a fee of $5 into the Faculty's fund for the aid of indigent students.

CHARACTER OF THE EXAMINATIONS.

The examinations are rigorous and cover the entire ground laid down in the following scheme. They are all conducted in writing, supplemented by an oral examination at the option of the examiner.

Each candidate for admission must be at least sixteen years of age, and must present a testimonial of good moral character from his last instructor, or from the school or institute to which he last belonged, or from some reputable citizen of the community in which he lives.

Candidates for admission to

THE CLASSICAL COURSE

are examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as those of Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition.

Greater stress will be laid, year by year, upon accurate and idiomatic use of the vernacular, upon correct pronunciation, clearness and facility in expression and in the presentation of ideas, an acceptable style in writing,—in short, upon all that may fairly be expected of the student as the result of a thorough and intelligent preparation in English. To gain this end, it may be well to use the list of books prescribed for admission to the New England colleges. These are, for 1896, Shakespeare's Midsummer Night's Dream; Defoe's History of the Plague in London; Irving's Tales of a Traveller; Scott's Wood-

stock; Macaulay's Essay on Milton; Longfellow's Evangeline; George Eliot's Silas Marner. For these may be substituted the books announced in the Register for 1894–95, viz., Scott's Lady of the Lake, Dickens's David Copperfield, Irving's Sketch Book, Hawthorne's Marble Faun. The books prescribed for 1897 are as follows: Shakespeare's As You Like It; Defoe's Journal of the Plague Year in London; Irving's Tales of a Traveller; Hawthorne's Twice Told Tales; Longfellow's Evangeline; George Eliot's Silas Marner. The student is also urged to the fullest possible use of all the opportunities for vocal culture which his means of preparation afford.

Attention is called to the fact that the right is reserved to regard hereafter all examination papers, upon whatever subject, as part of the English examination.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution*.

4. *Arithmetic*, including the metric system of weights and measures.

Note.—In 1897, and thereafter, Arithmetic will be omitted from the requirements for admission.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures.

[Chauvenet's Geometry (four books) is recommended, that being the text-book used in the University.]

7. *Physical Geography.*

8. *Latin Grammar.*

9. *Cæsar*, four books of the Gallic war.

10. *Cicero*, six orations, including the four against Catiline.

11. *Vergil*, the first six books of the Æneid, including Prosody.

12. The translation, at sight, of passages from Cæsar and Cicero.

13. The translation of English into Latin. (As special importance is given this part of the examination, it is suggested to teachers that they connect exercises in making Latin, both oral and written, with all the studies of the preparatory course.)

14. *Roman History.*—Creighton, Pennell, or Myers.

15. *Greek Grammar.*

16. *Xenophon*, Anabasis, four books.

17. *Homer*, Iliad, first three books, including Prosody. The Catalogue of Ships may be omitted.

18. The translation, at sight, of a passage from some work of Xenophon.

19. *Greek History.*—Fyffe, Pennell, or Myers.

20. Writing Greek with accents.

The pronunciation of Greek according to the written accents is followed in the University, and it is desirable that students preparing to enter be taught this system.

Latin is pronounced according to the method generally known as the Roman Method.

THE LATIN-SCIENTIFIC COURSE.

Candidates for admission to this course must present the first fourteen of the above requirements, but substitute for the Greek sections (numbers 15–20 inclusive) the following:

21. *Geometry.*—Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles: these constituting the subject matter of Books Five and Six of Chauvenet's Geometry.

THE COURSE IN SCIENCE AND LETTERS.

Candidates for admission to this course are examined in all the subjects demanded of those entering the Latin-Scientific Course, except the Latin and Physical Geography sections (numbers 7–14 inclusive). They also present the following:

22. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; or Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory by the student and the calculation of problems arising in the work.]

THE SCHOOL OF TECHNOLOGY.

Candidates for admission to the Courses in Civil Engineering, Mechanical Engineering, Mining Engineering, Electrical Engineering, Chemistry, and Architecture are examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as those of Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition.

Greater stress will be laid, year by year, upon accurate and idiomatic use of the vernacular, upon correct pronunciation, clearness and facility in expression and in the presentation of ideas, an acceptable style in writing,—in short, upon all that may fairly be expected of the student as the result of a thorough and intelligent preparation in English. To gain this end, it may be well to use the list of books prescribed for admission to the New England colleges. These are, for 1896, Shakespeare's Midsummer Night's Dream; Defoe's History of the Plague in London; Irving's Tales of a Traveller; Scott's Woodstock; Macaulay's Essay on Milton; Longfellow's Evangeline; George Eliot's Silas Marner. For these may be substituted the books announced in the Register for 1894–1895, viz., Scott's Lady of the Lake,

Dickens's David Copperfield, Irving's Sketch Book, Hawthorne's Marble Faun. The books prescribed for 1897 are as follows: Shakespeare's As You Like It; Defoe's Journal of the Plague Year in London; Irving's Tales of a Traveller; Hawthorne's Twice Told Tales; Longfellow's Evangeline; George Eliot's Silas Marner. The student is also urged to the fullest possible use of all the opportunities for vocal culture which his means of preparation afford.

Attention is called to the fact that the right is reserved to regard hereafter all examination papers, upon whatever subject, as part of the English examination.

It is recommended that candidates have a knowledge of Latin Grammar, although an examination in it is not required for any courses except the Classical and the Latin-Scientific.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution*.

4. *Arithmetic*, including the metric system of weights and measures.

Note.—In 1897, and thereafter, Arithmetic will be omitted from the requirements for admission.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures. Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles; these constituting the subject matter of the first six books of Chauvenet's Geometry.

[Chauvenet's Geometry is recommended, that being the text-book used in the University.]

Note.—In 1897, and thereafter, the examinations for admission to the Freshman Class in the School of Technology will include Solid Geometry.

7. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; or Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory and the calculation of problems arising in the work.]

Division of Examinations for Admission.

Candidates for admission to the Freshman Class may pass all the examinations in June, or all in September, or partly in June and partly in September, or may take them in *two consecutive years.* In the latter case, for the Technical courses and the course in Science and Letters, candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, and Arithmetic. No credit will be given unless the candidate has passed satisfactorily in at least three subjects at one examination.

The examinations in Algebra, Geometry, and Physics must be passed in June or September of that year in which the candidate proposes to enter the University.

In the Latin-Scientific and Classical courses candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, Arithmetic, Physical Geography, Roman History, and Greek History. No credit will be given unless the candidate has passed at least four of the subjects at one examination.

The examination in Latin may also be divided, but no credit will be given unless the candidate has passed in at least three of the topics specified at one examination. The examinations in the remaining subjects must be passed in June or September of that year in which the candidate proposes to enter the University.

Candidates intending to enter the University in September are advised to present themselves for examination in

June; if they are not fully prepared at that time they will receive credit for the examinations then satisfactorily passed.

CONDITIONAL ADMISSION.

A candidate failing to pass in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to his class conditionally, to make up his deficiencies by extra study. When they are made up, he will be received into full standing in his class.

SPECIAL STUDENTS.

Young men of advanced standing, who do not desire to take a full regular course, can enter and select special shorter courses, with the sanction of the Faculty; but in all cases satisfactory examinations must be passed upon the subjects required for entrance to the Freshman Class.

ADMISSION TO ADVANCED STUDIES.

Candidates for admission to advanced studies *in any course* are required to pass, *in addition to the entrance examinations for that course*, examinations in the work already done by the classes which they desire to enter. These examinations are held on the same days as those for entrance to the Freshman Class.

The additional subjects may be found in the program of studies.

A diploma showing that a degree has been conferred, or a certificate of studies taken at another College will be received, in so far as it covers the subjects required for entrance, in lieu of the *Primary Entrance Examinations only.*

ADMISSION TO GRADUATE COURSES.

Students of this University who have taken their *first* degree, and others, on presenting a diploma of an equivalent degree conferred elsewhere, are admitted to advanced studies, according to the plan to be found in the Register under the general subject of Graduate Students.

PREPARATORY SCHOOL CERTIFICATES.

The acceptance of a certificate as evidence of proficiency in lieu of examination is at the discretion of each Professor as to the subjects in his department. It has been the custom to accept certificates from schools of high standing in English, Geography, and United States History, but not in Mathematics or Physics. Beginning with the examinations of June, 1897, such certificates will not, as a rule, be accepted so as to dispense with the primary entrance examination in any subject. It is, however, regarded as highly desirable that the examiners should receive from principals of preparatory schools statements with reference to those whom they send up as candidates for entrance, indicating as clearly and fully as possible, in each case, the teacher's opinion of the candidate's character and scholarship and fitness for entering upon collegiate work; and such statements will receive careful consideration, in connection with the results of the entrance examinations.

PROGRAM OF STUDIES.

Showing the number of exercises per week for each subject, and the Text-books used.

The following is presented as the general program of instruction, subject to such modifications from time to time as the Faculty may deem expedient, with the approval of the Trustees.

The names of the text-books studied are generally mentioned. The number of exercises per week in each subject is indicated by the figure in parenthesis immediately following.

Two hours of drawing, three of work in the laboratory, or three of practice in the field, are regarded as equivalent to a recitation or lecture of one hour's duration.

SCHOOL OF GENERAL LITERATURE.

There are three courses in the School of General Literature of the University.

I. The Classical Course includes all that is prescribed in our best institutions for the degree of Bachelor of Arts (B.A.). It covers full instruction in Greek, Latin, English, French and German, Mathematics, Astronomy, Physics, Chemistry, Geology, Physiology, Hygiene, History, Psychology, Ethics, Philosophy, Political Economy, and Constitutional Law.

II. The Latin-Scientific Course differs from the first in omitting Greek, taking in its place an increased amount of the Modern Languages and of Mathematics. Students completing this course receive the degree of Bachelor of Science (B.S.).

III. The Course in Science and Letters, for which the same degree is given as for the last mentioned, contains no Latin or Greek, but furnishes instead extended instruction in French and German, History, General Literature, Mathematics, and General Science.

Instruction in all of these courses is given both by recitations and by lectures.

A student taking a literary course will be permitted to substitute, at the discretion of the Faculty, studies offered in one or another of the technical courses for a portion of the required work during Junior and Senior years. Such a student will receive the literary degree at the end of the fourth year. If he then desires to pursue the remaining branches in the technical course, he may receive the appropriate degree as soon as this is completed. The amount of additional time thus occupied will be probably from one and a half to two years, depending upon the courses selected and the diligence of the student.

It is believed that the benefit from such a combined course, which unites the advantages of literary training with a professional course, will recommend itself to many persons, and that the maturer condition of the student when he approaches his later work will enable him to make better use of the opportunities then afforded him.

DESCRIPTION OF THE COURSES.

GREEK.—During the first term of Freshman year the class reads several books of the Odyssey, giving attention to epic forms and syntax, to prosody and scanning, and to Homeric antiquities and mythology. The work of the second term is directed toward a thorough acquaintance with the idiom and vocabulary of Attic prose, as a preparation for rapid reading. The Œconomicus and Symposium of Xenophon and the Crito of Plato are read during the term, with sight readings from the Memorabilia and the Apology; accompanied with discussions of domestic life at Athens. The work of the year includes a thorough re-

view-drill on the principles of Greek accidence and syntax, and exercises in Greek prose composition are required, based, during the second term, on the reading done by the class. Greek history is studied throughout the year, with special reference to the development of political institutions.

The Sophomore class takes up, during the first term, the study of Herodotus and Thucydides. Selections are made from both authors with the purpose of illustrating their best style and at the same time of presenting, from the original sources, the history of certain interesting epochs; the reading from Herodotus, after some drill on the Ionic forms, being in large part at sight. During the second term the class reads one or two plays of Euripides, with attention to the history of Greek tragedy, the life of the author, and the analysis of the drama read. The lyric meters are studied, with the aim of gaining a knowledge of the rhythmical and metrical principles of Greek poetry. During this term an elective course is offered, the subject being Greek oratory, with the reading of certain orations of Lysias or Demosthenes, or both.

The Junior year is devoted to a further study of the drama, selected plays of Sophocles, Aristophanes, and Æschylus being read during the year. Work is also done in the study of public and private antiquities, partly in lectures by the professor and partly in original investigation on allotted subjects by the students.

During the first term of the Senior year the class reads either selections from Thucydides, or one of the dialogues of Plato. The second term is in part devoted to the reading of selected odes of Pindar, with careful study of the history of Greek lyric poetry and of the life and work of Pindar in particular. The course concludes with a review of the history of Greek literature, intended to summarize and harmonize the fragmentary views of the general subject gained from the study of particular authors and departments of literature.

LATIN.—Much of the training in the Freshman year is devoted to laying a good foundation in Latin grammar and in the translation of English into Latin. The authors studied are used to illustrate both of these, and a large amount is read at sight in order to cultivate quickness and readiness in the student. Roman history is begun, accompanied with full comments and lectures upon points of interest. Collateral reading will also be recommended each year throughout the course. Cicero: De Senectute and De Amicitia or the Philippics, Livy, and the Odes and Epodes of Horace are read this year. With the last named, training is given in Latin meters.

During this and the following year courses of lectures will be given upon Roman antiquities in addition to a text-book. The topography of Rome with its remains, ancient life in its various aspects, and the other departments of archæology will be discussed, illustrated by the new and extensive set of over 3600 magic lantern slides which have been prepared for this purpose.

The Sophomore year completes the text-book on Roman history. Quintilian (Bk. X) with Crowell's Selections from the Lyric Poets will be read in the first term, and in the second the Agricola and Germania, with selections from the Annals of Tácitus, together with sight reading.

In the Junior year, selected letters of Cicero and Pliny are read, followed by Persius and several plays of Terence and Plautus. The history of Roman literature is entered upon in the second term.

The work in the Senior year opens with Lucretius, accompanied with lectures on Roman philosophy. The course in the second term this year includes the study of ancient Latin, using Allen's Remnants of Early Latin, supplemented by a series of lectures upon Latin Grammar and the history of the development of the language, together with several lectures upon the history of classical philology. Characteristic poems by various authors will be read with full comment and training in the discussion of the literary and critical points which come up.

HEBREW.—An elementary course in Hebrew, conducted by the Chaplain, is offered as an optional study, open to Seniors and Juniors of the whole University.

ENGLISH.—During the first term, Freshman year, Rhetoric is studied, both with the aid of a text-book and through practical exercises, with the design of stimulating invention and imparting the essentials of a clear prose style. In the second term, a brief history of the language is made the nucleus of work.

The Sophomores spend the first term in a careful study of all that is most typical in American literature; the second, in a critical study of the prose of DeQuincey, Macaulay, and Carlyle, following that with a rapid survey of English prose from the XIV to the XIX century.

The Juniors study models of the best Oratory, both English and American, as a preliminary to the writing and delivery of original orations at some time during the first term; and, during the second, specimens from the works of standard Essayists as models for original essays. Careful training is given in the writing and criticism of essays throughout the course. These will be frequent rather than long; on subjects partly literary and in part technical; and the student will be led to maintain a specific thesis with orderly balance of arguments and arrangement of parts. The usual aimless discussion of what are styled "common terms," will be discouraged.

Excellence in Oratory is encouraged by the annual contest for the Alumni Prizes, held on the 22d of February, and open to students of the Junior class in all courses.

Instruction in elementary Anglo-Saxon is given regularly for one term to the Juniors in the School of General Literature, to be followed in the next term by a more critical study of the philology and history of the language than would be possible without such an introduction.

Seniors in the same school receive instruction in the early English of Chaucer and his contemporaries, and in the principles and practice of versification. They are required to write a short poem, or a critique of some book, of a

purely literary cast, selected for their examination and review. The course is completed by a series of lectures on the English poets from Chaucer to Tennyson, and, later, by lectures on special topics in English Literature too important to be passed over with brief mention, yet too comprehensive to be treated earlier in the course. Topics for 1897 will be taken from the following list: (1) Influence of the Celtic Writings and Traditions of Britain on the Literature of England. (2) The Historical and Literary Value of Anglo-Saxon Literature. (3) The English Bible as an English Classic. (4) The Elizabethan Writers. (5) The Greater Victorian Poets.

Optional courses will be offered as occasion arises. A Reading Club will be formed, and the student will be encouraged to such private and supplementary reading as his time will permit, and to the formation of a small library of standard books.

MODERN LANGUAGES.—The study of modern languages is obligatory from the first term of the Sophomore year up to the close of the course. The student elects either French or German; or both, if time permits.

French.—The grammar is begun, reading being introduced immediately. The comparative and historical relations of the French to the English, and the connection of both with the Latin are carefully explained. As soon as possible the student is emancipated from the Reader and takes up, in a progressive way, the reading of different authors; preference being given to modern writers, because it is considered to be of the highest importance that he acquire the language as it is, as an instrument whereby further knowledge can be obtained.

In the class-room, the language taught is used by the teacher as much as possible, in order that the ear of the pupil may become accustomed to its sound. Dictation is also employed, in order to give training in spelling. The rules of grammar are taught by numerous written exercises. In the second term of the Junior year, compositions

in French are required, upon subjects which have been previously explained in French, in order that the student may become acquainted with different expressions and forms of construction. Before entering upon the study of an author's works, his life and literary achievements are discussed in French, which is translated, if necessary. In the Senior year, twelve lectures are delivered upon the history of French literature. In addition to this, lectures in French upon the most distinguished modern authors are given to advanced students.

A weekly conversation-class affords opportunity for this kind of practice; and in it the events of the day and various historical and literary topics are discussed. Private courses of reading are also suggested to those who desire it.

German.—The German course follows the same plan as that laid down for the French, both as regards the methods employed and the opportunities afforded. The relations of English and German are dwelt upon and also those which connect the two languages with the Indo-European family.

MATHEMATICS.—The mathematical work is carried on during the Freshman and Sophomore years as follows:

Freshman year, first term, solid geometry, four exercises per week.

Second term, higher algebra; plane and spherical trigonometry, including mensuration and use of logarithmic tables, together five exercises per week throughout the term.

Sophomore year, first term, analytical geometry, four exercises per week.

Second term, differential and integral calculus, four exercises per week. This term's work is elective for the Classical Course.

ASTRONOMY.—This study is taken up during the first term of the Senior year, Young's General Astronomy being used as the text-book. There are three exercises a week, and visits to the observatory help to make the work interesting as well as profitable.

CHEMISTRY.—This study includes a complete course of lectures in Freshman year upon general inorganic chemistry, in which the principles of the science are fully covered. These are illustrated by experiments, and are sufficiently extended to enable a student who desires to pursue the subject further to take analytical chemistry as an elective in the second term of the Sophomore year. The text-book used in connection with the lectures is Remsen's Inorganic Chemistry.

PHYSICS.—This important subject is presented in a course of lectures during the first term of the Sophomore year, three times a week. These are illustrated by means of the very complete apparatus of the physical laboratory. In the course in Science and Letters, the work in this branch is more extended and is identical with that given to the Civil and Mechanical Engineers. It occupies five hours a week in the first term, when heat, magnetism, and electricity are discussed. Throughout the second term, three hours a week are devoted to sound and light.

GEOLOGY.—In the second term of the Senior year, a course of lectures is given in connection with Le Conte's text-book. The general principles of the science are explained, and the theories of the formation and stratification of rocks, the successive periods of the development of the earth's crust, the extinct forms of life and similar questions are treated.

PHYSIOLOGY AND HYGIENE.—These subjects are taught in a course of lectures during the Freshman year.

HISTORY AND POLITICAL SCIENCE. — The study of history begins with a course in the political antiquities of Greece and Rome. [See the Departments of Greek and Latin.] This is followed by the study of an outline of universal history (with text-book), and this by a fuller study of the political history of recent times, especially of that of England and France. During the first term of Senior year, there is a course of lectures upon the period covered by Gibbon's Decline and Fall of the Roman Empire.

The course in history is accompanied and supplemented by courses of lectures on constitutional law with special application to the Constitution of the United States; and also on international law.

Instruction is given by lectures on the elements of political economy. The student is made familiar with the facts, methods, and doctrines of the science, and is encouraged to form and present his own opinions.

LOGIC.—Junior Class, first term, two hours weekly. Textbook, Prof. Jevons' "Lessons in Logic," supplemented by occasional lectures and by references to more extended logical treatises, such as those of J. S. Mill, Sir William Hamilton, Archbishop Thompson, Baynes' Port Royal Logic, etc.

MENTAL AND MORAL PHILOSOPHY.—The work in this department will be conducted chiefly by lectures, interrupted by occasional examinations. The courses at present are the following:

Outlines of Physiological Psychology.—Junior Class, second term. These lectures are founded principally on Wundt's lectures on the same subject, Wundt's Grundzüge der Physiologischen Psychologie, James' Psychology, Baldwin's Handbook, Ladd's Elements of Physiological Psychology, Lotze's "Medicinische Psychologie," Ranke's "Der Mensch," Sully's Outlines of Psychology, Carpenter's Mental Physiology, Maudsley's Physiology and Pathology of the Mind, Bain's Mind and Body, etc., with references to the classical works of Weber, Fechner, and Helmholtz.

The History of Philosophy.—Senior Class, both terms. First term, Ancient and Medieval Philosophy. Second term, Modern Philosophy. These lectures will include a statement of the conception and problems of philosophy, a brief sketch of the great ethnical religions, and of the history of Oriental philosophy. The philosophy of the Greeks will be treated in detail, with illustrations from the writings of the philosophers.

The history of medieval philosophy will be prefaced by a short description of the philosophical ideas underlying

Christianity, and it will contain an account of the more important Church Fathers and Schoolmen.

The history of modern philosophy will begin by tracing the effect on philosophical thought of the ideas contributed by the Renascence and by the Reformation. From Lord Bacon on, a detailed history of the great modern philosophical systems will be given, which will be continued to those of our own times, including that of Mr. Spencer.

ANTHROPOLOGY.—Senior Class, both terms. These lectures aim at laying the foundation of a scientific study of Man. They include the rudiments of anthropometry and craniology. The earlier lectures give an account of the development, structure, and life of the human body; while the later lectures endeavor to describe the salient peculiarities of existing and prehistoric races of men.

They are based, for the most part, on the works of Bischoff, Broca, Darwin, Hartmann, Haeckel, Huxley, Quételet, Ranke, Virchow, etc.

CHRISTIAN EVIDENCES. — Senior Class, second term. Lectures on Christian evidences, which will endeavor to treat of the subject both from the side of natural science and from that of biblical criticism.

No complete course in Ethics has as yet been established, but the history of ethics is included in the history of philosophy.

THE COURSE IN SCIENCE AND LETTERS

substitutes the following for the Latin and Greek:

DRAWING.—In the first term of the Freshman year the student is instructed in elementary projections, shading, and lettering.

ZOÖLOGY AND BIOLOGY.—The study of these subjects covers one year, beginning with the second term of Sophomore year. The work begins with a description of the various animal functions, and is extended to the comparative anatomy and physiology of the organs in typical species. Systematic zoölogy is then completed and followed by practical biology.

CHEMISTRY.—In addition to the course in general chemistry described above, three exercises a week in qualitative analysis are taken in the second term of the Freshman year.

MINERALOGY.—Instruction in mineralogy is given to the students in the Course in Science and Letters throughout the Junior year. In the first term, they attend a course of lectures on crystallography, followed by a series of practical exercises in the determination of crystalline forms by the aid of models and natural crystals.

In the second term a course on the physical properties of minerals and on descriptive mineralogy, with the use of E. S. Dana's Text-Book of Mineralogy, is followed by practical exercises in the determination of minerals.

GEOLOGY.—The study of lithology is pursued in the first term of the Senior year, with laboratory practice, Williams' Lithology being used as the text-book. During the next term, the course given above is taken with the Classical and Latin-Scientific students.

THE CLASSICAL COURSE.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Solid geometry. (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (3)

Greek.—Homer: Odyssey. Prosody. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (3)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (1) Essays.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Greek.—Xenophon: Œconomicus. (3)

Latin.—Livy completed. Horace: Odes and Epodes. Composition and prosody. (4)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

English.—Rhetoric. (1) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry. (5)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's French Reader. (2) Or *German.*—Brandt's Grammar. Lodeman's Manual of Exercises. Buchheim's Reader. (2)

Greek.—Herodotus. (3)

Latin.—Horace: Satires and Epistles. Composition. (2)

History.—History of Rome. (1) Antiquities.

English.—American literature. (1) Essays.

SECOND TERM.

French.—Grammar and reader (continued). (2) Or *German.*—Grammar, exercises, and reader (continued). (2)

History.—Weber's Outlines of Universal History. (2)

Greek.—Euripides: Medea. (3)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—English prose literature. (1) Essays.

In addition to the above exercises, four hours per week must be selected from the following elective studies:

Mathematics.—Differential and integral calculus. (4)

Greek.—Demosthenes: De Corona. (2)

Latin.—Plautus. (2)

French.—Grammar and reader. (2)

German.—Grammar and reader. (2)

Chemistry.—Stoichiometry and qualitative analysis (laboratory). (4)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Jevons's Lessons in Logic. (2)

English.—Anglo-Saxon. (2) English and American Orators. (1)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Greek.—Sophocles: Antigone. Antiquities. (3)

Latin.—Letters of Cicero and Pliny. (3)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Philology of the English Tongue. (2) British Essayists. (1)

French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Buchheim's Prose Composition. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Greek.—Aristophanes: Clouds. Æschylus: Prometheus. (3)

Latin.—Persius, Plautus, and Terence. History of Roman literature. (3)

SENIOR CLASS.

FIRST TERM.

History.—Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

English.—Chaucer and his contemporaries. (2)

French.—Sadler; Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French literature. (2) Or *German.*—Grammar. Readings in Lessing, Herder, Goethe, Schiller, etc., and contemporary authors. Compositions. Lectures on German literature. (2) Conversation class in both languages optional throughout the year.

Greek.—Plato: Phædrus. Greek philosophy. (2)

Latin.—Lucretius, with lectures. Roman literature. (2)

SECOND TERM.

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (2)

Christian Evidences.—Lectures. (1)

English.—Study of versification. (2)

French.—Readings. Compositions. Lectures in French on modern French authors. (2) Or *German.*—Readings. Compositions. Lectures in German on modern German authors. (2)

Geology.—Lectures. Le Conte. (2)

Greek.—Pindar: selected odes. Greek literature. (2)

Latin.—Cicero: De Officiis. Lectures on the history of classical philology. (2)

Preparation of Thesis.

THE LATIN-SCIENTIFIC COURSE.

The Latin-Scientific Course, leading to the degree of Bachelor of Science (B.S.), is based on Latin without Greek.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Solid geometry. (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (3)

German.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (3)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (1) Essays.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

German.—Grammar. Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

Latin.—Livy (completed). Horace: Odes and Epodes. Composition and prosody. (4)

English.—Rhetoric. (1) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry. (5)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German.—Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

Latin.—Horace: Satires and Epistles. Composition. (2)

English.—American literature. (1) Essays.

SECOND TERM.

Mathematics.—Differential and integral calculus. (4)

French.—Grammar. Reader (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

History.—Weber's Outlines of Universal History. (2)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—English prose literature. (1) Essays.

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Jevons's Lessons in Logic. (2)

English.—Anglo-Saxon. (2) English and American Orators. (1)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

Latin.—Letters of Cicero and Pliny. (3)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Philology of the English Tongue. (2) British Essayists. (1)

French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)

German.—Readings (continued). Dictation. Compositions. (2)

Latin.—Persius, Plautus, and Terence. History of Roman literature. (3)

SENIOR CLASS.

FIRST TERM.

History.—Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

English.—Chaucer and his contemporaries. (2)

French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Lectures on French literature. (2)

German.—Readings (continued). Compositions. Lectures on German literature. (1) Conversation class in both languages optional throughout the year.

Latin.—Lucretius, with lectures. Roman literature. (2)

SECOND TERM.

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (2)

Christian Evidences.—Lectures. (1)

Geology.—Lectures. Le Conte. (3)

English.—Study of versification. (2)

Latin.—Cicero: De Officiis. Lectures on the history of classical philology. (2)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Preparation of Thesis.

COURSE IN SCIENCE AND LETTERS.

The Course in Science and Letters, leading to the Degree of Bachelor of Science (B.S.), is designed for those who wish to pursue both scientific and literary studies without Latin and Greek. These being omitted, extended instruction is given in French and German, History, General Literature, Mathematics and General Science.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Solid geometry. (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (3)

German. — Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Elementary projections, shading and lettering. (2)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (2) Lectures. (1) Essays.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

History.—History of Greece. (2) History of Rome. (1)

German.—Grammar. Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—History of the English language. (2) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry. (5)

Physics.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Laboratory. (2)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German. — Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

English.—American literature. (2) Essays.

SECOND TERM.

Mathematics. — Differential and integral calculus. (4)

Physics. — Heat, magnetism, and light. Lectures. (2) Laboratory. (1)

Zoölogy.—Lectures. Orton. (2)

French.—Grammar. Readings (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. (2)

History.—Weber's Outlines of Universal History. (2)

English.—English prose literature. (2) Essays.

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Jevons's Lessons in Logic. (2)

English.—Anglo-Saxon. (2) English and American Orators. (1)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

Zoölogy.—Lectures on biology. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Philology of the English Tongue. (2) British Essayists. (1)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Compositions. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

SENIOR CLASS.

FIRST TERM.

History.—Decline and Fall of the Roman Empire. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

English.—Chaucer and his contemporaries. (2)

French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French Literature. (2)

German.—Readings (continued). Compositions. Lectures on German Literature. (1)

In both languages conversation class optional throughout the year.

Geology. — Williams' Lithology and laboratory practice. (2)

SECOND TERM.

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (2)

Christian Evidences.—Lectures. (1)

English.—Study of versification. (2)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Geology. — Historic and dynamic geology. LeConte. (3)

Preparation of Thesis.

THE SCHOOL OF TECHNOLOGY.

This school includes seven distinct courses:

I. The Course in Civil Engineering.
II. The Course in Mechanical Engineering.
III. The Course in Mining Engineering.
IV. The Shorter Course in Mining.
V. The Course in Electrical Engineering.
VI. The Course in Chemistry.
VII. The Course in Architecture.

These have the same curriculum of studies for the first term of the Freshman year; except that students who propose to take the course in Mechanical Engineering or that in Analytical Chemistry are required to take German. After the first term the student follows the program of the course which he has selected.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Solid geometry. (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (3)

French.—Whitney's Practical French Grammar. Super's Reader. (3) Or *German.*—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Free-hand sketching and lettering. (2)

English.—Rhetoric. (2) Lecture. (1) Essays.

Physiology and Health.—Lectures. (1)

THE COURSE IN CIVIL ENGINEERING.

The special technical studies in this course may be grouped under the heads of Surveying, Applied Mechanics, Road and Railroad Construction, Bridge Design, and Hydraulic and Sanitary Engineering.

The work in Surveying extends over four terms and embraces land surveying, leveling, topography, triangulation, railroad reconnaissance and location, hydrography, and the elements of geodesy. A large equipment of transits, levels, and other surveying tools affords students the opportunity of becoming familiar with the instruments of different manufacturers. Much time is devoted to practice in the field and drafting room, each student being required to become proficient in the use of instruments, in taking field notes, and in map-drawing. Particular attention is paid to the execution of topographical surveys and maps by the best modern methods. Railroad maps and profiles are made from actual field location. During the Senior year there is done secondary triangulation work of a high order of precision.

The work in Applied Mechanics comprises the strength and elasticity of materials, the theory of the equilibrium of arches, roofs and bridges, that part of the mechanics of machinery which relates to locomotives and hoisting machines, and the theory of hydraulics and hydraulic motors. Here the theoretical principles are illustrated by examples and problems taken as far as possible from actual engineering practice. Tests and experiments on materials are made in the testing laboratory.

The course in Construction familiarizes the student with the qualities of materials used in engineering structures, with methods of preservation and testing, with masonry and foundations, and with the building and maintenance of roads and railroads. All the standard tests for hydraulic cements and mortars are made by each student.

The course in Bridge Design is preceded by the theory of computation of stresses by both analytical and graphic methods. Starting with the specifications for a first-class iron highway or railroad bridge, each student then makes the full computations, designs, working drawings, and bills of material for a plate girder, a lattice girder, and a pin-connected truss bridge. The weight of the designed bridge is finally determined and compared with the dead load

assumed for the calculations. The drawings are made and dimensioned in the same manner as in the drafting-office of a bridge company. In connection with this course visits of inspection to bridges in the vicinity are regularly made.

The work in Hydraulic and Sanitary Engineering begins with the study of systems of water supply, the collection, purification, and distribution of water, the combined and the separate systems of sewerage, the methods for the disposal of sewage, and the best practice for the drainage of houses. This is followed by the theory of the flow of water in pipes and channels, together with the subject of hydraulic motors.

Besides these special studies there is a course in astronomy, which includes practical work in the observatory. The study of English, and of French or German, is continued, and instruction is given during four terms in crystallography, mineralogy, lithology, and geology.

The student who completes all the studies of this course will receive the degree of Civil Engineer (C.E.).

FRESHMAN CLASS.

FIRST TERM.

See page 48.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Construction.—Materials, masonry, and carpentry. Roads, streets, and pavements. Sketches of structures. (2)

Projection Drawing.—Descriptive geometry and isometric drawing. Tracings and drawings of structures. (4)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—History of the English language. (2) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry. (5)

Physics.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Laboratory. (2)

Architectural Drawing.—Plans of piers and arches. Problems in stone cutting. Use of water colors. (3)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—American literature. (2) Essays.

SECOND TERM.

Mathematics.—Differential and integral calculus. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

Land Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (4)

Physics.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

French.—Grammar. George Sand: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—English prose literature. (2) Essays.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Calculus and mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Work in the testing laboratory. (4)

Construction.—Foundations, arches, walls, dams, and bridges. Visits of inspection. (3)

Topographic Surveying.—Field work with transit and stadia, and with plane table. Topographic maps. (3)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

English.—English and American Orators. (1)

SECOND TERM.

Railroad Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. (4)

Roofs and Bridges.—Theory and calculations of stresses in roof and bridge trusses. (4)

Sanitary Engineering.—Collection, purification and distribution of water. Systems of water supply and sewerage. Disposal of sewage. House drainage. Irrigation engineering. (3)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

French or German.—Readings. Compositions. Lectures on French or German literature. (1) Technical readings. (1)

English.—British Essayists. (1)

SENIOR CLASS.

FIRST TERM.

Astronomy.—Young's General Astronomy. (3)

Bridges.—Graphic statics. Design of plate girders, riveted bridges, and pin-connected trusses, with working drawings. (7)

Geodetic Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (2)

Mechanics of Machinery.—Pile drivers, cranes and elevators. The mechanics of the locomotive. (2)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (2)

SECOND TERM.

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Bridges.—Theory of cantilever, draw, continuous, suspension, and arched structures. (3)

Hydraulics.—Hydrostatics. Efflux of water from orifices and flow in pipes and rivers. Hydraulic motors. (3)

Electricity.—Equipment and operation of electric railways. Measurement of power. (2)

Geology.—Historic and dynamic. Le Conte. (3)

Christian Evidences.—Lectures. (1)

Preparation of Thesis. (3)

THE COURSE IN MECHANICAL ENGINEERING.

The object of this course is the study of the Science of Machines. The principal subjects taught are: The nature, equivalence, and analysis of mechanisms, the mechanics or theory of the principal classes or types of machinery, Mechanical Technology, and the principles and practice of Machine Design.

That the students may obtain the practical engineering data which they will most need when beginning their work as mechanical engineers they are required to pursue a course of Shop Instruction which does not necessarily involve manual labor and manipulation of tools, but is principally devoted to familiarizing them with those points in pattern-making, moulding, forging, fitting and finishing, which they need to know as designers of machinery. Particular attention is therefore directed to the forms and sizes of machine parts that can be readily constructed in

the various workshops, to the time that it takes to perform, and the order of, the various operations, to the dimensions most needed by workmen and to the various devices for increasing the accuracy of the work, durability of the parts, and convenience of manipulation. This involves acquaintance with the processes and machinery of the workshops, but it is the foreman's and superintendent's knowledge which is required rather than the manual dexterity and skill of the workman and tool-hand. The acquirements peculiar to the latter are by no means despised and the students are encouraged to familiarize themselves therewith during leisure hours, but manual work in the shops forms no regular part of the course. On the contrary, the student enters the shop with hands and mind free to examine all processes, operations, and machinery, and is ready at the call of the teacher to witness any operation of special interest. Provided with note-book, pencil, calipers, and measuring rule, the student sketches the most important parts of the various machine-tools, notes down the successive steps of each of the important shop-processes as illustrated by the pieces operated upon, and follows the pieces of work through the shops from the pig or merchant form to the finished machine.

That the students may learn to observe carefully and be trained to think and observe for themselves in these matters, there is required of them a full description of the various processes, operations, and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings, and finished pieces, which are not being constructed in the shops at the time and the drawings for which have been given to them on entering the shops. The student's work is directed not only by these drawings and by the printed program given him at the start, but also personally by a teacher, who accompanies him into the shops, gives necessary explanations, and tests the extent and accuracy of his knowledge by examining the sketches and notes and by frequent questioning. Finally the results of the observations and the sketches are embodied in a memoir.

During the course there are frequent visits of inspection to the Bethlehem Iron Company, the L. V. R. R. Shops at Easton, and other engineering works both in and out of town, with special reference to such subjects as machine elements, prime movers, machinery for lifting, handling and transporting, and machinery for changing the form and size of materials. It is intended that each of these excursions shall have some definite purpose in view which must be fully reported by the students. These visits are also made the occasion for constant practice in the free-hand sketching of machinery.

The instruction in Machine Design begins with second term of the Freshman year and is continued throughout the course. At first tracings and blue prints of good examples of machine drawings are made. A thorough drill in projection drawing follows; in this work free-hand sketches are first made, and measurements taken, of machine pieces; these sketches are then converted into full-size working drawings. Then there is considerable practice in the interpretation of such drawings, and general views of lathes, planers, drills, and shapers are made from the drawings of the details. This is followed by difficult projections and intersections and exercises in the empirical proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice and the drawings made full size. During the Junior year the class takes up the design of a high-speed steam engine, every dimension being determined by the students and complete drawings made. During the Senior year the students undertake the calculations, estimates, and working drawings involved in the design of a simple but complete machine, each student being engaged upon a different machine. From the finished drawings of each machine tracings are made and then blue prints taken for distribution among the other members of the class. In the case of the machines and of the engine the general plan or arrangement will be given to the stu-

dents in the form of rough sketches, photographs, or woodcuts. In the last term the students are expected to make original designs for simple machinery, whose object has been fully explained. Throughout the course the work in the draughting-room is carried on as nearly as possible like that of an engineering establishment, and special attention is paid to methods of expediting the work of calculation by means of simple formulas, tables, and diagrams.

All the students in this course are required to study German.

The graduates in this course will receive the degree of Mechanical Engineer (M.E.).

FRESHMAN CLASS.

FIRST TERM.

See page 48.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Drawing and Machine Design.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (5)

Visits of Inspection.—Examination and sketching of principal machine parts in the shops of the vicinity. (1)

German.—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—History of the English language. (2) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry. (5)

Physics.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Laboratory. (2)

Machine Design.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers, and connecting rods. (2)

Visits of Inspection.—Examination and sketching of principal machine parts in the shops of the vicinity. (1)

German.—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—American literature. (2) Essays.

SECOND TERM.

Mathematics.—Differential and integral calculus. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

Physics.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

Steam Engine.—Holmes' Steam Engine. (4)

German.—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—English prose literature. (2) Essays.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Calculus and mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on experimental tests. (4)

Mechanics of Machinery.—Hermann-Smith. Graphical Statics of Mechanisms. (2)

Mechanical Technology.—Shop instruction. Examination of the processes and appliances involved in pattern-making, moulding, forging, fitting, and finishing, with sketches and reports. (5)

Boilers.—Wilson. Strength, construction, and wear and tear of boilers. (1)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class optional throughout the year.

English.—English and American Orators. (1)

SECOND TERM.

Kinematics of Machinery.—Nature and equivalence of mechanisms. Diagrams of the changes of position, speed, and acceleration in mechanisms. Valve and link motions. (6)

Machine Design.—Calculations and working drawings for a high-speed steam engine. (5)

Machinery of Transmission.—Weisbach-Herrmann. (3)

German.—Readings. Compositions. Lectures on German literature. (1) Technical readings. (1)

English.—British Essayists. (1)

SENIOR CLASS.

FIRST TERM.

Thermodynamics. — General principles; application to steam engines and air compressors. (3)

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Machine Design.—Calculations and working drawings for hoisting, pumping, and metal-working machinery. (3)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (5)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Mechanics of Machinery.—Weisbach-Herrmann. Hoisting machinery, accumulators, cranes, and locomotives. (2)

SECOND TERM.

Mechanics of Machinery.—Weisbach-Herrmann. Pumps, pumping engines, blowing engines, compressors, and fans. (4)

Machine Design.—Original designs. (5)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

THE COURSES IN MINING ENGINEERING.

These courses aim to fit the student for practical work in either of the branches of mining, metallurgy, metallurgical chemistry, or geology. On account of the great number and scope of the studies necessary to the attainment of the degree of Engineer of Mines (E.M.), which includes that of Metallurgist, five years are required. At the end of the fourth year the student will have completed a course similar to that leading to the scientific degree in other institutions, and will receive the degree of Bachelor of Science (B.S.). On completing the first year, those who desire to practice mining alone are provided with a special course leading to the degree of Bachelor of Science (B.S.) in mining. The following program of subjects and studies shows the requirements for the degree of Engineer of Mines.

MODERN LANGUAGES.—Although the option of studying French or German lies with the student, it may be well to note that the current literature of the subjects taught in these courses is more abundant in the latter language.

DRAWING AND CONSTRUCTION.—The course in mechanical drawing begins with tracings of good examples of machine drawings; then follow the interpretation of such drawings, and the making of general views of machines from detailed sketches, exercises in projection drawing from the same, and the proportioning of simple tools and machines.

A brief course in descriptive geometry is given, in which the student is grounded in the fundamental principles of the subject. The simpler applications are given in the form of problems, and a number of practical examples are worked out in the drawing room.

Under the charge of an instructor, the students make visits of inspection to mines and metallurgical works, during which they examine and make sketches of portions of the plant, and take notes concerning it. From these sketches and notes they subsequently make working drawings accompanied by written memoirs explanatory of the construction and operation of the plant.

In a later portion of the course, the students are required to make original designs for mining and metallurgical plant under given conditions, involving exercise in the adaptation and proportioning of structures, machinery, and apparatus to suit the conditions given.

The field work in mining and geological surveying is followed by map construction from field notes.

CHEMISTRY. — The course in theoretical and applied chemistry extends over three years and includes work in wet and dry assaying of all the important ores and metallurgical products met with in actual practice, combined with the working of stoichiometric problems and the study of chemical philosophy. The practical work is that required for a metallurgical chemist or assayer.

With moderate care the expenses in this department need not exceed $120.

MINERALOGY.—This subject is divided into two courses. In the first course, after a short exposition of the laws of

crystallography and a description of crystalline forms, practical exercises are held in the determination of simple and complex crystals, in which the student is taught to identify the various crystalline forms observed in minerals by the aid of models and of actual crystals, and with the use of the application goniometer. The second course includes the subjects of physical, descriptive, and determinative mineralogy. As in the first course, the greater part of the time is devoted to practical exercises, which, in this course, have for their object the determination of minerals. Each student is thus enabled to become familiar with the more common minerals by the actual handling of several hundred specimens, with the facility of making such tests as will not injure them. The presence of one or more instructors during each exercise permits the student to make frequent reports of his determinations, and to receive much instruction as to the characteristics of the minerals. The knowledge thus acquired can be supplemented by visits to the museum.

The course in blowpipe analysis may be considered as auxiliary to the practical exercises in determinative mineralogy. In the latter the student is urged to rely chiefly on physical tests; in the former he is required to determine minerals by the aid of the blowpipe.

The mineralogical laboratory offers facilities for an advanced course in crystallography and in physical and microscopic mineralogy to a few students who may receive permission to pursue such a course.

GEOLOGY.—This subject is studied with special reference to the needs of the mining engineer. Within a radius of twenty miles the student meets and becomes acquainted with the rocks of the archæan, the palæozoic, and the mesozoic formations, and makes geological maps from his own field notes, paying attention to the lithological characters of the formations, as they are mainly non-fossiliferous south of the Blue Ridge. An extended practical course in lithology familiarizes the student with the rocks of importance to the mining engineer and enables him to determine them

by sight. There are over 2500 specimens in the collections, embracing nearly all the known species. The course in historic geology is illustrated by a cabinet of typical specimens. The course in economic geology supplements the above work by familiarizing the student with the geological horizon of all the valuable constituents of the earth's crust and the theories of their formation. As Bethlehem is near the center of the "extra-moraine" drift, exceptional facilities are afforded for the study of pleistocene geology in Eastern Pennsylvania.

ASTRONOMY.—After studying the theory of the subject two-thirds of the year are devoted to practical work in the observatory.

APPLIED MECHANICS.—This embraces hydraulics, a study of the steam engine, and the mechanics of machines employed in mining and metallurgy.

SURVEYING.—A course extending over five terms offers practice in land, mine, and geological surveying, leveling, topography, triangulation, railroad reconnaissance and location, and the use of the solar transit. It also includes practical work in drawing and map construction.

METALLURGY.—There are two courses, making, together, about one hundred and forty lectures on this subject, which extend throughout a year. In these the chief object kept in view is a clear presentation of the principles involved in the various metallurgical processes, looked upon as the application to practice of the laws of chemistry, physics, and mechanics. This is followed, in the case of each process, by a description of the more important examples of the plant and of the methods of conducting the process, and by indications concerning its economic features. In order to ensure the student's understanding the fundamental principles of metallurgy, and his becoming so familiar with them as to be able readily to apply them, he is required to solve a series of problems in which these

principles are involved. Many of the problems are such as are likely to present themselves to the metallurgist in his current practice.

The metallurgical laboratory affords opportunity for special investigations in subjects connected with metallurgy to such advanced students as are competent to conduct them.

MINING.—This subject is covered by three courses. The first begins with the application of economic geology to the needs of the engineer, so that he can study and value mining properties, locate appropriately the necessary plant, and calculate the cost of production. It includes the discussion of faults and the means of finding faulted bodies, with practical problems. The subjects of blasting, timbering, and winning deposits are applied to actual cases, as tunnel-driving, etc., and problems from practical data are solved by the students. The second course covers the subjects of underground and surface haulage; loading, unloading, and stocking ores; pumping; ventilation; hygiene and mining law. A series of problems is given in each of these subjects to cover cases that meet the engineer in ordinary practice. The third course treats of the mechanical preparation of ores by the wet, dry, or magnetic methods, and especially of the preparation of anthracite coal.

The location of the University in the vicinity of the iron works of the Lehigh Valley, and especially of the extensive establishment of the Bethlehem Iron Company, affords unusual facilities for the practical study of iron metallurgy. The processes for the manufacture of spelter and oxide of zinc may be studied at the Bethlehem Zinc Works. The facilities for the practical study of mining and economic geology are not excelled by those of any other institution in the country. The zinc mines at Friedensville, the paint ores of the Marcellus formation, and the brown hematite and slate deposits of the Lehigh Valley are in the immediate vicinity, while within easy reach by rail are the semi-bituminous and anthracite coal fields, the block and fossil iron ores of the Clinton measures, the iron mines at Corn-

wall, Pennsylvania, and the iron and zinc mines of New Jersey; together affording examples of nearly all the methods of winning and dressing valuable deposits. Numerous visits of inspection are made in connection with the work of the course, to familiarize the student with metallurgical and mining processes and afford data for practical examples and projects.

THE COURSE IN MINING ENGINEERING.

This course is arranged so that the subjects which prepare the student for practice in the field of metallurgy shall be completed at the end of four years, when the graduate will receive the degree of Bachelor of Science in Metallurgy (B.S.). By remaining a year longer, and taking the subjects laid down for the graduate year, the graduate in the course may obtain the degree of Engineer of Mines (E.M.).

FRESHMAN CLASS.

FIRST TERM.

See page 48.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (5)

Stoichiometry. (2)

French.—Grammar and reader (continued). (3) *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—History of the English language. (2) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics. — Analytical geometry. (5)

Physics.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Laboratory. (2)

Drawing.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches. General views from given details. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., accompanying the study of descriptive geometry and illustrated from examples of mining and metallurgical plant. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—American literature. (2) Essays.

SECOND TERM.

Mathematics.—Differential and integral calculus. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

Physics.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

Drawing.—Flat tinting with water colors. Graphical problems illustrating the direction and extent of throw in faults. Examination and sketching of metallurgical plant in the vicinity. General views and working drawings of the plant examined, accompanied by written descriptions of its construction and operation. (4)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—English prose literature. (2) Essays.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Calculus and mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Chemistry.—Fresenius' Quantitative Analysis. (3) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Copper ore (Cu).
3. Silver coin (Au, Ag, Pb, Cu).
4. Zinc ore (Zn). By both gravimetric and volumetric methods.
5. Bronze (Cu, Sn, Zn, Pb).
6. Spiegeleisen (Mn).

Chemical Philosophy.—Tilden. Chemical calculations. Whiteley. (3)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2)

Conversation class in both languages optional throughout the year.

English.—English and American Orators. (1)

SECOND TERM.

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Quantitative analysis: laboratory work: Fresenius. (3) The following analyses are executed by the student:

7. Lead ore (Pb,S).
8. Ilmenite (TiO_2).
9. Iron ore (complete analysis).
10. Limestone (complete analysis).
11. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).

Steam Engine.—Holmes' Steam Engine. (4)

Land Surveying.—Theory and use of level and transit. Field practice and map drawing. (2)

French or German.—Readings. Compositions. Lectures on French or German literature. (1) Technical readings. (1)

English.—British Essayists. (1)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (5)

Blow-Pipe Analysis.—Practice. (1)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Mechanics of Machinery.—Herrmann-Smith. The graphical statics of mechanisms. (2)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Chemistry. — Quantitative analysis: laboratory work: Fresenius. (2) The following analyses are executed by the student:

12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).
15. Nickel ore (Ni, Co).
16. Gas analysis.

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

SECOND TERM.

Mining.—Mechanical preparation of ores. Coal washing. Lectures. (2)

Metallurgy.—Of copper, lead, silver, gold, &c. (4)

Drawing.—Designing of furnaces and other metallurgical plant. (2)

Mechanics of Machinery. — Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

GRADUATE YEAR.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (4)

Geology.—General geological definitions and principles. Dynamic geology. Dana. (2)

Drawing.—General views of mining plant and detailed sketches. (3)

Astronomy.—Young's General Astronomy. (3)

Topographic Surveying.—Field work, with transit and stadia, and with plane table. Topographical maps. (3)

Mine Surveying.—Theory and problems. (1)

SECOND TERM.

Geology.—Historic geology. Dana. (2)

Projects.—In geology and mining. Designing of mining plant. (3)

Mining.—Prospecting. Economic geology. Boring. Valuation of property. Methods of mining. Lectures. (4)

Mine Surveying.—Practice, with construction of mine maps. (1)

Railroad Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. (4)

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Preparation of Thesis.

THE SHORTER COURSE IN MINING.

This course is so designed that the student who desires to pursue the practice of mining and ore-dressing, and who does not wish to take the full course, may be prepared for practice in four years, receiving the degree of Bachelor of Science in Mining (B.S.).

For such students as may take the surveying of second term sophomore year in the summer school at the end of freshman year, or that of first term junior year at the end of sophomore year, or both, advanced work will be provided in such subjects as may be agreed upon by the student and the professor in charge of the department.

FRESHMAN CLASS.

FIRST TERM.

See page 48.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

Drawing.—Tracings and blue prints. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., illustrated from examples of mining and metallurgical plant. (4)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—History of the English language. (2) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry. (5)

Drawing.—Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches.

General views from given details. Graphical problems illustrating the direction and extent of throw in faults. (2)

Physics.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Laboratory. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—American literature. (2) Essays.

SECOND TERM.

Mathematics.—Differential and integral calculus. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

Land Surveying.—Theory and use of level and transit. Field practice and map-drawing. (2)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—English prose literature. (2) Essays.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Calculus and mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Geology.—General geological definitions and principles. Dynamic geology. Dana. (2)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Topographic Surveying.—Field work with transit and stadia, and with plane table. Topographical maps. (4)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

English.—English and American orators. (1)

SECOND TERM.

Geology.—Historic geology. Lectures. Dana. (2)

Mining.—Prospecting. Economic geology. Boring. Valuation of property. Timbering and walling. Support of excavations. Tunneling. Systems of mining. Lectures. (3)

Steam Engine.—Holmes' Steam Engine. (4)

Railroad Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. (4)

Physics.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

French or German.—Readings. Compositions. Lectures on French or German literature. (1) Technical readings. (1)

English.—British Essayists. (1)

SENIOR CLASS.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (4)

Physics.—Electricity and magnetism. Lectures with recitations; text-book, Slingo and Brooker's Electrical Engineering. (3)

Geodetic Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (2)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Mechanics of Machinery.—Herrman-Smith. The graphical statics of mechanisms. (2)

Mine Surveying.—Theory, with problems in tunneling, shaft location, and survey of bore-holes. (1)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

SECOND TERM.

Mining.—Mechanical preparation of ores. Coal washing. (2)

Projects.—In mining. Designing of mining plant. (4)

Mechanics of Machinery.—Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Mine Surveying.—Practice, with construction of mine maps. (1)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN PHYSICS AND ELECTRICAL ENGINEERING.

In the arrangement of the details of this course the object has been to provide for those who seek to fit themselves as Electrical Engineers a preliminary training as complete and broad as that given to the members of the other schools. The requirements for admission, the mathematical and English studies, the modern languages, and other outside branches are the same as those in the other technical courses. To these have been added such por-

tions of the other technical courses as are necessary to give the student a general but sufficiently accurate knowledge of all the allied subjects.

The main feature of the course is the prominence given to the subject of Physics. This extends through three years, and while Electricity is specially developed the other branches, Elementary Mechanics, Heat and Light, are fully provided for. The opportunity is thus given to any one who wishes to acquire a more extensive knowledge of Physics than the University curriculum has heretofore offered. The student is well drilled in the theory by means of lectures and recitations, which carefully cover the whole subject, and he is required to go over the ground himself in the best of all schools—the working laboratory. Enough work on each topic is given him to render him familiar with his subject. Much prominence is given to work that brings out the resources of the student himself, such as the construction of instruments and original investigation. He is encouraged to this and a regular portion of his time is set apart for this object.

It will be seen from the preceding statement that this course offers two great advantages: the thorough and extensive training of those intending to take part in the great development of Electric Science in the industrial field now going on and the facilities offered to those who wish to take a four years' course specially devoted to the whole subject of Physics.

The practical work of the Physical, the Electrical, and the Dynamo Laboratories, is too extensive to allow of full details being given in the following arrangement of the course. The more important subjects developed may be mentioned. In Mechanics, exact measurements, specific gravity, barometric leveling. In Heat, calorimetry and hygrometry. In Light,testing of optical instruments, spectroscopic analysis and photometry. In Magnetism, study of laws of force, determination of moments of magnets and of horizontal component of intensity of earth's magnetism in absolute units. Attention is also given in the Junior year, both in

lectures and laboratory work, to the investigation of the magnetic properties of iron, magnetic moment, intensity of magnetization, magnetic induction, permeability, susceptibility, hysteresis, etc. In Electricity, management of batteries, construction of instruments and their calibration, measurement of resistance and other electrical measurements, electrolysis and relation of electrical currents to heat and mechanical work; study of direct and alternating current dynamos and motors and practical running, care and tests for efficiency, etc.; a determination of the resistance, characteristics, and saturation curves, exploration of field, coëfficient of magnetic leakage, etc.; electric lighting, with photometric tests of arc and incandescent lamps; measurement of heat units given off by lamps, their resistance (hot and cold); energy consumed in lamps; spectroscopic tests of purity of carbons; study of telegraph and telephone and of the application of electricity to street railways; visits to manufactories, working systems, electric railways, etc.

The work in Dynamo Design consists of a study of the principles of dynamo-electric machinery by lectures and recitations, and also of the practical calculation and design of dynamos for incandescent work, multipolar generators, stationary motors and street railway motors, alternate current apparatus, including generators, motors, and transformers. The design of street railway systems is also taken up, and long distance transmission of power. The preparation of the Thesis forms an important part of the work for the Senior year. It will consist of original investigation and research, in theoretical or applied electricity. The student is thrown upon his own resources as much as possible, and is made to rely on himself.

Through the generosity of members of the Board of Trustees, an important addition has been made to the apparatus of this department. It includes a 50 h. p. engine, an 80 cell storage battery, some machines for advanced alternating current work, a 2-phase alternator and motor, etc.; a lathe and workshop tools, and a number of standard

instruments of the finest kind for exact electrical measurements.

A deposit, varying in amount in the different laboratory rooms, but not exceeding $25 for the year, is required from each student before he is allowed to work in any laboratory. From this, at the end of the year, is retained the cost of any material wasted or apparatus injured by him during the term.

The degree of Electrical Engineer (E. E.) will be given to the graduates of this course.

FRESHMAN CLASS.

FIRST TERM.

See page 48.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

Projection Drawing.—Descriptive geometry and isometric drawing. Tracings and drawings of structures. (4)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—History of the English language. (2) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry. (5)

Physics.—Heat. Magnetism and electricity. Lectures, with study of text-book. (2) Laboratory. (2)

Machine Design. (2)

Chemistry.—Fresenius's Quantitative Analysis. (2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—American literature. (2) Essays.

SECOND TERM.

Mathematics.—Differential and integral calculus. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

Steam Engine.—Holmes' Steam Engine. (4)

Physics.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

Chemistry.—Lectures on Photography. (1)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—English prose literature. (2) Essays.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Calculus and mechanics. (2)

Electricity.—Ayrton's Practical Electricity. (2)

Magnetism.—Ewing's Magnetic Induction in Iron. (2)

Electrical Laboratory. (3)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Boilers.—Wilson. Strength, construction, and wear and tear of boilers. (1)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

English.—English and American Orators. (1)

SECOND TERM.

Dynamo-electric Machinery.—S. P. Thompson's Dynamo-electric Machinery. (3)

Alternating Currents.—Bedell and Crehore's Alternating Currents. (3)

Electrical Laboratory. (3) Text-books recommended: Nichols's Junior Course, Fleming's Forms, Stewart and Gee's Practical Physics.

Telegraphs and Telephones.—Lectures. (3)

Surveying.—Theory and use of instruments. Location and construction of electric railways. (2)

French or German.—Readings. Compositions. Lectures on French or German literature. (1) Technical readings. (1)

English.—British Essayists. (1)

SENIOR CLASS.

FIRST TERM.

Dynamo-electric Machinery.—S. P. Thompson's Dynamo-electric Machinery. (2)

Designing Room. (3)

Electric Light and Power.—Lectures. (2)

Dynamo Laboratory. (3) Text-book recommended: Nichols's Senior Course.

Measurement of Power.—Indicating of steam engines and dynamometer experiments. (1)

Mechanics of Machinery.—Herrmann-Smith. The graphical statics of mechanisms. (2)

Thermodynamics. (3)

SECOND TERM.

Dynamo-electric Machinery.—S. P. Thompson's Polyphase Electric Currents and Kapp's Transformers. (2)

Designing Room. (2)

Dynamo Laboratory. (3)

Electro-metallurgy. (1)

Electric Railways.—Recitations. Plans for an electric railway, with maps, specifications, etc. Long distance transmission of power. Text-book : Crosby and Bell's Electric Railways. (2)

Hydraulics.—Flow of water through orifices, pipes, and channels. Hydraulic motors. (3)

Christian Evidences. (1)

Preparation of Thesis.

THE COURSE IN CHEMISTRY.

This course of study is designed to prepare students for the profession of the chemist, in connection with metallurgical establishments, sugar refineries, gas works, superphosphate works, electrical machinery manufactories, mining companies, etc., and the general consulting and analytical work of the professional chemist. It is also well adapted to the preparation of teachers of chemistry and as a course preliminary to the study of medicine. It is eminently practical, the student's time being largely occupied by practical work in the large, well equipped and well ventilated chemical laboratories, which were completed in 1885 and constitute the best constructed building for this purpose in this country. The museum of chemistry contains large collections of specimens, for illustrating the lectures on theoretical and applied chemistry.

Theoretical Chemistry.—Instruction in this subject begins with lectures four times a week, in the first term of the Freshman year. These lectures are fully illustrated by experiments, colored diagrams, working drawings and lantern pictures, and specimens from the museum. They include a general introduction to theoretical chemistry, and a description of the non-metallic and metallic elements and their compounds, the general subject of inorganic chemistry. The students are required to take notes of the lectures, and to pass a written examination at the end of the term.

In the second term of this year stoichiometry and chemical problems and reactions are taught by recitations twice each week.

The study of theoretical chemistry is continued throughout the Sophomore year by recitations three times a week from Tilden's Chemical Philosophy, Whiteley's Chemical Calculations, and Remsen's Chemistry; in the first term of the Junior year, by a course of lectures and recitations on theoretical organic chemistry, four times a week and twice a week in the second term. These lectures are illustrated by experiments and by specimens from the museum of chemistry.

Written examinations are held at the close of each of the above courses.

ANALYTICAL CHEMISTRY.—Qualitative analysis is taught in the second term of the Freshman year, by lectures, recitations, and practical work in the qualitative laboratory, twelve hours of practical work per week being required. This laboratory is a large, well ventilated, and well lighted room, supplied with convenient working tables, vacuum filtration, hoods for noxious vapors, steam baths, gas and washing appliances, and a commodious room for hydrosulphuric acid. Distilled water is delivered by faucet in this room and the other large laboratories. At the close of the term a practical examination is held in this subject.

After completing this course, quantitative analysis is pursued throughout the Sophomore and the first term of the Junior years. This subject is taught by lectures, recitations, and practical work in the quantitative laboratory, which is equipped like the qualitative laboratory, but is supplied in addition with apparatus for drying precipitates and residues, rooms for the chemical balances, for combustions, and for a reference library.

Twelve hours per week are required during the first term of the Sophomore year and fifteen hours during the second term of that year and the first term of the Junior year.

The course consists in gravimetric and volumetric analyses, as applied to the substances given in the lists farther on, accuracy being required in the determination of each constituent.

At the close of each term written examinations are held upon the theory and practice of quantitative analysis.

GAS ANALYSIS is taught by lectures and laboratory practice in the gas laboratory. This laboratory is supplied with full and complete apparatus for gas analysis, according to Bunsen's processes, as well as apparatus for some of the more rapid methods. Mixtures of gases are required to be analyzed by the students, within certain limits of error, and a written examination, on the theory and practice, is held at the close of the course.

ASSAYING.—The assaying of ores by furnace assay, together with gold and silver bullion analysis, by processes practiced in the United States Mint, is taught by lectures and practical work in the first term of the Senior year, nine hours of practical work per week being required. The course includes the assaying of ores of lead, tin, antimony, gold, silver, and iron, coal, and gold and silver bullion.

The assaying laboratory is supplied with large working tables, twenty-nine crucible and two iron furnaces, and eight muffle furnaces, with adjoining rooms for balances, and gold and silver bullion analysis.

A certain accuracy of results and a written examination as regards theory and practice are required.

ORGANIC CHEMISTRY.—The practical work in this subject is performed in the second term of the Junior year, fifteen hours per week being required, with conferences and recitations each week. The laboratory for this work is equipped similarly to the quantitative laboratory, in addition being supplied with steam, cold water and air blast upon the working tables, and a full supply of apparatus for the various determinations and experiments, including com-

bustion furnaces, furnaces for heating sealed tubes, mercury pump, Hoffman's, Dumas' and Meyers' apparatus for vapor densities, nitrometers, chemical balances, etc.

The course consists of determinations of specific gravities, melting points, boiling points, vapor densities; chlorine, bromine, iodine, and sulphur of organic substances.

Combustion analysis, nitrogen determination, fractional distillation, and the preparation of fifty pure organic compounds and a number of analyses are included.

INDUSTRIAL CHEMISTRY.—A course of lectures is delivered upon this subject in the second term of the Senior year, illustrated by experiments, diagrams, lantern pictures, and specimens from the museum of chemistry. The working laboratories for this subject contain an apparatus for making illuminating gas, an alcohol still, worm and doubler, and a complete working model of a sugar refinery, including filters, vacuum pan, and centrifugal. There is also apparatus for use in the manufacture of chemicals, for dyeing, calico printing, and bleaching. In connection with these laboratories is a room containing a photometer and apparatus for determining the sulphur, ammonia, and specific gravity of illuminating gas; also a laboratory for the testing of alcoholic liquors, sugar, molasses, bone black, soap, petroleum, paints, dyes, superphosphates, tallow, illuminating and lubricating oils, rubber, explosives, paints, asphalts, and other commercial products, with the necessary technical apparatus. The students make practical experiments in this direction, and, with an instructor, visit various industrial establishments in this neighborhood and in and around New York City.

TOXICOLOGY.—A course of lectures on this subject is given in the first term of the Junior year, illustrated by experiments and by the large collection of specimens of poisons from the museum of chemistry. This is supplemented by a short course of laboratory work on some of the common poisons.

SANITARY CHEMISTRY.—During the second term of the Senior year attention is given to the qualitative and quantitative examination of air, water, food, disinfectants, baking-powders, flour, bread, tea, coffee, cocoa, spices, milk, butter, lard, beer, and other subjects connected with this branch of the science. Special apparatus is provided for this work, as recommended by the best authorities on the subject.

PHOTOGRAPHIC CHEMISTRY.—A well equipped photographic laboratory and dark rooms are provided, in which the students of the chemical course receive practical instruction.

PHYSIOLOGICAL CHEMISTRY.—The examination of urine, blood, organic and inorganic poisons, etc., receives a proper amount of attention.

The course also includes instruction in physics, mineralogy, blowpipe analysis, metallurgy, and geology, which are of great value to the chemist.

MICROSCOPY.—Instruction in the use of the microscope is given in the first term of the Senior year.

In the Senior year the student is required to prepare a thesis on some subject, selected by the Professor of Chemistry, involving practical work in the laboratory in addition to the literary labor, each graduate thus making a contribution to the progress of the science, as a preliminary to the reception of his degree.

The graduate of this course receives the degree of Analytical Chemist (A.C.).

Students, not candidates for a degree, are admitted to special courses in chemistry, of which they will receive certificates.

The laboratories are under the immediate charge of the Professor and Instructors of Chemistry and are open to the students from 8 o'clock A.M. to 6 o'clock P.M., including Saturdays. Students are at liberty to work in the laboratories beyond the required hours as their time may permit.

Students are charged for materials and apparatus consumed; with moderate care this expense need not exceed $50 per year.

FRESHMAN CLASS.

FIRST TERM.

See page 48.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (5)

Stoichiometry. (2)

German.—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—History of the English language. (2) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Chemical Philosophy.—Tilden. Chemical calculations. Whiteley. (3)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

1. Iron wire (Fe).
2. Potassium dichromate (Cr_2O_3).
3. Barium chloride (Ba, Cl, H_2O).
4. Magnesium sulphate (MgO, SO_3, H_2O).
5. Disodium hydrogen phosphate (P_2O_5).
6. Rochelle salt (K_2O, Na_2O).
7. Volumetric determination of chlorine.
8. Acidimetry (HCl, H_2SO_4, HNO_3, $HC_2H_3O_2$).
9. Alkalimetry (KOH, NaOH, NH_4OH, soda ash, pearl ash).
10. Chlorimetry (bleaching powders).

Quantitative Analysis.—Conference. (1)

Physics.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Laboratory. (2)

German.—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—American literature. (2) Essays.

SECOND TERM.

Physics.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

11. Copper ore (Cu).
12. Zinc ore (Zn). By both gravimetric and volumetric methods.
13. Lead ore (Pb, S).
14. Silver coin (Au, Pb, Ag, Cu).
15. Spiegeleisen (Mn).
16. Copper alloys (complete analysis).
17. Ilmenite (TiO_2).
18. Iron ore (complete analysis).
19. Limestone (complete analysis).
20. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).
21. Slag (complete analysis).

Quantitative Analysis.—Conference. (1)

Chemistry.—Remsen. Advanced course. (3)

German.—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—English prose literature. (2) Essays.

JUNIOR CLASS.

FIRST TERM.

Toxicology.—Lectures. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

22. Guano (NH_3, P_2O_5, H_2O).
23. Clay (complete analysis).
24. Manganese ore (MnO_2).
25. Mineral water (complete analysis).
26. Pig iron (complete analysis).
27. Nickel ore (Ni, Co).
28. Carbon in steel (volumetric).
29. Gas analysis.

Quantitative Analysis.—Conference. (1)

Organic Chemistry.—Lectures and recitations. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class optional throughout the year.

English.—English and American Orators. (1)

SECOND TERM.

Organic Chemistry.—Laboratory. (6)

Organic Chemistry.—Conference. (1)

Metallurgy.—Of copper, lead, silver, gold, etc. (5)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. E. S. Dana. (3)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

German.—Readings. Compositions. Lectures on German literature. (1) Technical readings. (1)

English.—British Essayists. (1)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Assaying.—Including the assay by the dry method of gold, silver, antimony, lead, iron, and tin ores, coal, gold and silver bullion, and rich lead. Ricketts. (3)

Industrial Chemistry.—Laboratory. (3)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Microscopy.—Laboratory. (2).

Blow Pipe Analysis.—Practice. (1)

Preparation of Thesis.

SECOND TERM.

Industrial Chemistry.—Lectures. (3)

Industrial Chemistry.—Laboratory. (3)

Industrial Chemistry.—Conference. (1)

Agricultural Chemistry.—Laboratory. (1)

Sanitary Chemistry.—Laboratory. (1)

Geology.—Historic and dynamic geology. Lectures. LeConte. (3)

Christian Evidences.—Lectures. (1)

Preparation of Thesis. (4)

THE COURSE IN ARCHITECTURE.

The studies in this course are closely allied with those in civil engineering, the higher surveying, railroad work, mineralogy, geology, and astronomy being omitted; instead of which architectural designing is substituted, as seen in the following program. Instruction is also given in the history and æsthetics of architecture, in methods of heating and ventilating, in boilers and hoisting machinery, and in house drainage and sewerage.

During the first and second years the student lays the foundation for his professional work by the study of mathematics, physics, mechanics, drawing, surveying, English, and French or German. The course in drawing includes the use of water colors, free-hand, projection and isometric drawing, and their application to the general plans for masonry structures. In surveying there is field practice in the use of instruments, and also map drawing, thus enabling the student to understand the application

of the subject to landscape gardening, and to the location of buildings.

During the third and fourth years of the course the work is of a more professional character. The subject of construction familiarizes the student with brick, stone, cement, and other materials, with foundations and masonry, with arches, piers, and walls, and with the stone-cutter's art. There is a full course in the theory and calculation of columns, beams, and shafts, in the strength of materials and its application to roof trusses and bridges. Working drawings of arches, piers, and roof trusses are made in detail. Plans and estimates are prepared for wooden, brick, stone, and iron buildings, the work being done according to standard specifications. In connection with the course visits of inspection are made to engineering structures in the Lehigh Valley and vicinity.

The student who completes all the subjects of this course will receive the degree of Bachelor of Science in Architecture (B. S.).

FRESHMAN CLASS.

FIRST TERM.

See Page 48.

SECOND TERM.

Mathematics.—Algebra. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Construction.—Materials. Masonry. Carpentry. Roads and pavements. Sketches of structures. (2)

Projection Drawing.—Descriptive geometry and isometric drawing. Tracings and drawings of structures. (4)

French.—Grammar and Reader (continued). (3) Or *German.*—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—History of the English language. (2) Essays.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics. — Analytical geometry. (5)

Physics.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Laboratory. (2)

Architectural Drawing.—Plans of piers and arches. Problems in stone cutting. Use of water colors. (3)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—American literature. (2) Essays.

SECOND TERM.

Mathematics.—Differential and integral calculus. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

Physics.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (4)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—English prose literature. (2) Essays.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Calculus and mechanics. (2)

Strength of Materials. — Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Work in the testing laboratory. (4)

Construction.—Foundations, arches, dams, walls, and bridges. Visits of inspection. (3)

Perspective Drawing.—Shades, shadows, and linear perspective. Pen and ink rendering. (4)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

English.—English and American Orators. (1)

SECOND TERM.

Roofs and Bridges.—Theory and calculation of stresses in roof and bridge trusses. (4)

Sanitary Engineering.—Collection, purification, and distribution of water. Systems of water supply and sewerage. Drainage and sewerage of buildings. (3)

Architecture.—Designs and estimates for brick and stone buildings. (4)

History.—The history and styles of architecture. (2) Lectures on Roman antiquities. (1)

French or German.—Readings. Compositions. Lectures on French or German literature. (1) Technical readings. (1)

English.—British Essayists. (1)

SENIOR YEAR.

FIRST TERM.

Roofs and Bridges.—Graphic statics. Designs for plate girders, riveted and pin-connected roof trusses, with working drawings. (7)

Mechanics of Machinery.—Pile drivers, cranes, and elevators. (2)

Boilers.—Strength, construction, and wear and tear of boilers. Wilson. (1)

Architecture.—Specifications and estimates. Design for an iron building. (4)

Heating and Ventilation.—Systems of heating, lighting, and ventilating buildings. (2)

SECOND TERM.

Hydraulics.—Efflux of water from orifices, and flow in pipes and channels. Hydraulic motors. (3)

Roofs and Bridges.—Theory of cantilever, draw, continuous, and arched structures. (3)

Architecture.—Building superintendence. The æsthetics of architecture. Plans, specifications. (6)

Christian Evidences.—Lectures. (1)

Preparation of Thesis. (3)

PHYSICAL CULTURE.

The Gymnasium is open morning, afternoon, and evening; in all, 45 hours a week. Exercise in it is required of all students who are fitted to take it. Class drill with the Instructor and individual exercise are prescribed.

GRADUATING THESES.

Every student will be required to present a thesis upon some topic connected with his special course, as a necessary portion of the exercises for his final examination for a diploma. These theses shall be accompanied by drawings and diagrams, when the subjects need such illustration. The originals will be kept by the University, as a part of the student's record, for future reference; but a copy may be retained by the student, and be published, permission being first obtained from the President.

DIPLOMAS AND CERTIFICATES.

The Diploma is given only to those who have passed all the examinations in a regular course and is signed by the Secretary of the Board of Trustees and by the Faculty of the University. For all the partial courses a certificate is given, signed by the Secretary of the Faculty, and showing what the student has accomplished.

GRADUATE STUDENTS.

Graduate students wishing to remain a year or more and pursue a course of study as candidates for another Degree may do so with the sanction of the Faculty. Those wishing to take *special* courses of study will be afforded every facility for so doing.

GRADUATE DEGREES.

M. A.

The Faculty will recommend for the Degree of Master of Arts any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Arts, shall pursue, for at least one year at this University, or two years elsewhere, a course of liberal study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same, and present a satisfactory Thesis.

M. S.

The Faculty will recommend for the Degree of Master of Science any candidate, otherwise properly qualified, who, after taking at this University any Degree in the School of Technology, shall pursue, for at least one year at this University, a course of study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same and present a satisfactory Thesis. Graduates of the Latin-Scientific Course, or of that of Science and Letters, are permitted to study *in absentia* for the degree of M.S., subject to the same restrictions as those prescribed for candidates for the degree of M.A.

The Theses presented by candidates for Graduate Degrees shall be retained by the University.

Applicants for either of these degrees will be required to complete the prescribed work within the allotted time. Special action of the Faculty is required for any extension of time.

THE UNIVERSITY LIBRARY.

The Library building was erected by the Founder of the University in 1877, at a cost of $100,000, as a memorial of his daughter, Mrs. Lucy Packer Linderman, and during the same year more than $20,000 were contributed by her family and friends as a memorial fund for the purchase of books. By the will of the Founder of the University a fund of $500,000 has been given for the permanent endowment of the library.

The building is semi-circular in plan, with a handsome façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior, the center is occupied as a reading space, fifty by forty feet, from which radiate the book cases, extending from floor to ceiling; two galleries affording access to the upper cases. Shelf room is now provided for one hundred and sixty thousand volumes. The building is thoroughly fireproof, well lighted, and heated by steam.

Ninety-seven thousand volumes are now upon the shelves, including many extremely valuable works. The list of periodicals numbers about two hundred and fifty, embracing as far as possible all departments of knowledge.

The Library is conducted strictly for consultation, and is open to the use of the public; both of which conditions are in accord with the terms of the gift.

REGULATIONS OF THE LEHIGH UNIVERSITY LIBRARY.

I. The Library is open every day, except Sundays and Legal Holidays, from 8 A.M. until 10 P.M., and on Sundays for the students and others connected with the University from 1.30 P.M. until 9.30 P.M.

II. Admission is free to all persons over 16 years of age.

III. Readers are required to write their names and addresses in the Daily Register of the Library. They also write the name of the book desired upon a Library Card, with their signatures, and present

the same to the Director's Clerk, who supplies the book, retaining the card as a receipt. Before leaving the Library, readers return their books to the clerk, and receive their cards.

IV. The University Professors and Instructors, only, are allowed to take books from the Library Building.

V. No person is allowed to enter the alcoves, or remove any book from the shelves, without permission of the Director.

VI. Readers wishing to consult the more valuable illustrated works make special application for that purpose.

VII. In taking notes, pencils, and not pen and ink, are to be used.

VIII. Audible conversation and the use of tobacco are strictly forbidden in any part of the Library.

IX. Any person not conforming to these Regulations will be denied the privilege of the Library.

X. Any person who defaces, in any way, any book, magazine or paper, or the furniture, or any portion of the building, in addition to being deprived of the privileges of the Library will be prosecuted according to law.

OBSERVATORY.

By the liberality of Robert H. Sayre, Esq., one of the Trustees of the University, an astronomical observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

In the dome of the observatory is mounted an equatorial telescope, of six inches aperture, by Alvin Clark & Sons. The west wing contains a superior sidereal clock, by Wm. Bond & Sons; a zenith telescope, by Blunt, and a field transit, by Stackpole. There is also a prismatic sextant, by Pistor & Martins.

Students in practical astronomy receive instruction in the use of the instruments and in actual observation.

The grounds upon which the Observatory stands, consisting of seven acres of land adjoining the original grant, were presented to the University by Charles Brodhead, Esq., of Bethlehem.

THE UNIVERSITY MUSEUM.

In addition to the large collection illustrating all branches of Industrial Chemistry, the Museum includes collections in Metallurgy, Geology, Zoölogy, and Archæology.

The Metallurgical Cabinet already includes specimens illustrating the various processes for obtaining the more common metals.

The Zoölogical Cabinet includes the Werner collection of nearly all the types of American birds with their nests and eggs, and the Packer collection of recent shells.

The Geological Cabinet numbers over ten thousand specimens and includes the Palæontological, Mineralogical, Petrographic, and Economic collections. The first contains good specimens of nearly all the common genera. The Mineralogical division includes the Keim and Rœpper collections—the latter being especially complete and valuable from a crystallographic standpoint. The Petrographic division numbers several thousand specimens and, besides including numerous varieties of nearly all the rocks of the globe, contains a duplicate set from the collection of the Second Geological Survey of this State. The Economic division was formed and given by Dr. James P. Kimball, ex-Director of the Mint, and formerly Professor of Economic Geology.

The Cummings Archæological Cabinet numbers three thousand specimens and includes Dr. Stubbs' collection of Indian relics, weapons, and utensils.

SUMMER SCHOOL OF SURVEYING.

A Summer School of Surveying, extending over a period of four weeks, is held at the University during the long

vacation, provided that the attendance of at least twelve students is assured. In 1896 the school will open on Monday, June 22, at 8:30 A.M. Applications to join it should be made to the Professor of Civil Engineering before June 1, 1896. The tuition fee is $15, payable in advance.

Three courses in Surveying are offered in the Summer School:

A. Land and Town Surveying: corresponding to the course given to civil engineering students in the second term of the Sophomore year. This course is open to any student who has completed the Freshman year, or to any person having a good knowledge of geometry and trigonometry.

B. Topographical Surveying: corresponding to the course given to civil engineering students in the first term of the Junior year. This course is open to those who have completed course *A* or its equivalent.

C. Geodetic Surveying: corresponding to the course given to civil engineering students in the first term of the Senior year. This is open to those who have completed courses *A* and *B*.

At the close of the Summer School examinations are held and certificates given. Students of the University holding these certificates may omit the corresponding work in Surveying during the academic year and may, with the sanction of the Faculty, use the time thus gained in extra studies.

THE CHEMICAL AND NATURAL HISTORY SOCIETY OF THE LEHIGH UNIVERSITY.

This Society was organized in the Fall of 1871, as "The Chemical Society," but was afterwards expanded, as its present title indicates, and admits, by election, students from all departments of the University.

The collections of botanical and zoölogical specimens belonging to the Society are already important. During the past years persons have been sent to Texas and Brazil to collect specimens for these cabinets.

The Society has organized and maintained several courses of public scientific lectures.

THE ENGINEERING SOCIETY.

This Society was organized in 1873, and admits, by election, students in the Junior and Senior Classes. Its meetings are held fortnightly. At these, papers relating to engineering subjects are read and discussed. From 1885 to 1890 it issued quarterly five volumes of "The Journal of the Engineering Society," containing contributions by the members, alumni, and others. Many of the papers read before this society since 1890 have been published in "The Lehigh Quarterly."

THE MINING CLUB.

This was organized in 1883 and takes from the Junior, Senior, and Graduate Classes those members of the Mining School who excel in their studies or in practical experience in the subjects of the course.

THE ELECTRICAL ENGINEERING SOCIETY

was organized in November, 1887, by students in the Advanced Course in Electricity. Its object is to supplement the regular work of the department by the study and discussion of electrical subjects.

THE AGORA

is a literary and debating society which meets semi-monthly. Once restricted in its membership to students in the School of General Literature, in 1893 it was thrown open to all students. It has proved of great advantage to its members in the development of concise and logical thinking, the promotion of ease before an audience, and the acquirement of experience in parliamentary methods. The society has recently joined the Inter-collegiate Debating Union, and it is expected that this will increase the

interest already existing, and at the same time enlarge the knowledge of current affairs by the discussion of those subjects of the day which are prescribed by the Union.

THE CLASSICAL CLUB.

This organization was founded in the Spring of 1889, and consists of the students in the Classical and Latin-Scientific Courses, together with those members of the Faculty who are interested in this department of learning. At its monthly meetings, papers upon philological, historical, and archæological subjects are read by students belonging to the upper classes, and are then discussed and criticised. Thus independent work is encouraged and correct methods of investigation are acquired. This is especially valuable for those men who purpose becoming teachers or original investigators. Reports upon new discoveries and reviews of recent books vary the proceedings and keep the members informed in regard to the advances of philological science.

THE NATURAL SCIENCE CLUB OF THE LEHIGH UNIVERSITY.

The object of this organization is systematic study, in connection with field work, in natural history and its associated subjects. Its members are engaged in making a survey, both botanical and mineralogical, of the region within a radius of five miles from the University and propose to collect an herbarium and mineralogical cabinet which shall contain specimens of all the plants and minerals within this district.

THE ARCHITECTURAL CLUB.

This club was formed for the purpose of collecting photographic plates of buildings and plans, and to distribute prints of these among its members. Working drawings, models, and specimens of building materials have also been collected. During the past year a series of monthly competitions in pen and ink drawings was held. The active members of the club are students in the architectural and engineering courses.

THE MATHEMATICAL CLUB.

This club was organized in February, 1895. Its members are students in the Junior and Senior classes. Its object is to continue the study of higher mathematics after having completed the mathematical course of the University.

THE LEHIGH UNIVERSITY CHRISTIAN ASSOCIATION.

This is a voluntary organization of the students for the promotion of the religious, moral, and social life of the University. It was organized April 18, 1890, and on Oct. 11, 1890, united itself with the Intercollegiate Young Men's Christian Association. The movement is distinctly for and by students, all the officers being chosen from the student body. Those connected with Evangelical churches of whatever creed are eligible to *active membership; associate membership* may be claimed by men of good moral standing who are not members of churches. The association is continually growing, and is extending a marked influence for good among the men.

THE BIBLE CLASS.

A class for the reverent study of the sacred Scriptures, under the direction of the Chaplain, meets every Sunday afternoon at half past three o'clock. This class aims at both practical and theoretical results—the edification of its members in the Word of God, and the application of the "scientific" or "historical" method to the study of Holy Writ.

FOUNDER'S DAY.

On the second Thursday of October of each year, Commemorative Exercises are held in honor of the Founder of the University. On Thursday, October 11, 1895, the sixteenth Founder's Day was celebrated. An address was delivered by Thomas Messinger Drown, LL.D., President of the University. His subject was "The Educational Value of Engineering Studies."

UNIVERSITY SERMON.

This sermon is preached on the Sunday before University Day.

The Rt. Rev. C. Kinloch Nelson, D.D., Bishop of Georgia, was the preacher on Sunday, June 16, 1895, in the Packer Memorial Church.

THESES.

Theses on the following subjects were prepared by candidates for degrees in 1895:

FOR THE DEGREE OF E.M.

"The Drainage Problem of the Nottingham Colliery."

WILLIAM A. ALLGAIER.

"An Efficiency Test of the Ingersoll-Sergeant Air-Compressor at the Nottingham Colliery, Plymouth, Pennsylvania."

JOHN YOUNG BASSELL, JR.

"Investigation of the Working of Blast Furnace No. 6 of the Bethlehem Iron Company."

ROBERT B. BRINSMADE.

FOR THE DEGREE OF B.A.

"Lucretius's Love of Nature."

HENRY MILTON SNYDER CRESSMAN.

"Cicero's Ideas of the Roman Gods, as represented in his Discourse 'De Natura Deorum.'"

EDWARD CALVIN FERRIDAY.

"The Origin and History of Attic Comedy."

HOWARD SAMUEL HESS.

"The Influence of the Crusades upon the Civilization of Europe."

ELMER AUGUSTUS JACOBY.

"The Logos of Philo Judæus."

WILLIAM ALLEN LAMBERT.

"The Feudal System in England."

ROBERT S. SIEGEL.

FOR THE DEGREE OF B.S.

(LATIN-SCIENTIFIC COURSE.)

"The Development of the Lyrical and Pastoral Qualities in Alfred Tennyson."

DIXON KAUTZ.

(COURSE IN SCIENCE AND LETTERS.)

"Practical Money."

FAYETTE AVERY MCKENZIE.

"The Unification of the German Empire."

JOHN EUGENE STOCKER.

"History of the Trial by Jury."

ROBERT SAYRE TAYLOR.

FOR THE DEGREE OF C. E.

"Design of a Sewerage System for Chillicothe, Ohio."

HERMAN LEON ARBENZ.

"Review of the Sewerage System of Bradford, Pa."

ANTHONY FRANCIS BANNON, JR.

"Design of a Hydraulic Plant for an Electric Light Station for The Lehigh University."

JOHN COLLINSON BARBER.

"Investigation of the Stability of the New Dam at Holyoke, Mass."

ROLLIN CALVERT BASTRESS.

"Review of the Penn Street Bridge, Reading, Pa."

GEORGE BEGGS, JR.

"Location and Construction of a Highway between Allentown and Bethlehem."

JOHN HENRY BEST.

"The Turbine as a Water Meter."

WILLIAM BOWIE, B.S.

"The Masonry Dams of the State of Pennsylvania."

WALTER TURPIN BROWN.

"The Narrow-Gauge Railroad at Mt. Gretna, Pa."

JAMES HODGSON BUDD.

"Design of a Sewerage System for Flemington, N. J."
CHARLES CALVIN BURGESS.

"Design for a Parabolic Bowstring Truss at Freemansburg, Pa."
FRANCIS LEE CASTLEMAN.

"Plan for a Water Supply for Duncannon, Pa."
WILLIAM JOSEPH COLLIER.

"Topographical Map of the Country within three miles of The Lehigh University."
HERBERT MAURICE CRAWFORD.

"Estimate of Cost for Railroad Track and Coal Tipple at Brockwayville, Pa."
JAMES CHAMBERS DICK.

"The Drainage and Improvement of Broad Street, South Bethlehem, Pa."
ALFRED WILLIAM ALEXANDER EDEN.

"Design for a Bridge over the Lehigh River at Freemansburg, Pa."
EDWARD L. FAISON, JR.

"Systems of Water Supply for Irrigation in Mexico."
ANDRES GARZA GALAN.

"A Proposed Electric Railway from Bethlehem to Nazareth, Pa."
WALLACE RUSSELL GOSS.

"Design of a Sewerage System for Elkton, Md."
FREDERICK TAYLOR HAINES.

"Investigation of a Dam for Reservoir D at Carmel, N. Y."
THOMAS LLOYD HENRY.

"Experiments and Computations on the Deflection of a Bridge Truss."
IRA MILLER HIGBEE.

"Design of a System of Sewers for Manchester, Va."
HENRY SCUDDER JAUDON.

"Review of a Highway Bridge at Bloomsburg, Pa."
ELISHA BARTON JOHN.

"Temperature Stresses in the Deck Pratt Truss at Hokendauqua, Pa."

WARREN BYRON KEIM.

"Determination of Co-ordinates by the Three-Point Problem."

NORMAN PEACH MASSEY.

"Determination of the Exact Stresses and Reactions in a Draw Bridge."

CHARLES FRAZIER MAURICE.

"Design of a Separate System of Sewerage for West Bethlehem, Pa."

STUART TUTTLE MCKENZIE.

"Design of an Overhead Crossing for Northern Central R. R. at Williamsport, Pa."

ROBERT NEILSON, JR.

"Plan for a Water Supply for The Lehigh University."

JAMES HARRY PHILLIPS.

"The Utilization of the Water Power of the Lehigh River."

EUGENE JESSE RIGHTS.

"Comparison of four Pratt Trusses with odd and even Numbers of Panels."

HERBERT TIMOTHY RIGHTS.

"Designs and Estimates for several Retaining Walls 30 feet high."

HARRY KENT SELTZER.

"The Manufacture of Bricks."

JOHN FREDERICK VAN BENTHEM.

"Design of a Separate System of Sewers for South Bethlehem, Pa."

CHARLES HENRY VANSANT.

"Design of Main Sewers for South Bethlehem, Pa."

FRED IRVING WHEELER.

"Errors of Eccentricity and Graduation in three Engineers' Transits."

JOHN MARION WILSON.

FOR THE DEGREE OF M.E.

"The Theory and Practice of the Manufacture of Gear Wheels."

CLARENCE KEMBLE BALDWIN.

"Evaporation Test of a Boiler Plant."

ROBERT JOSIAH BARTHOLOMEW.

"Tests of Rapidity of Adjustment of a High-speed Engine Governor."

HARRY WILBER BEACH.

"The Exactness of Machine Construction."

CHARLES SUMNER BRICKER.

"Duty-test of Steam Pumps at the Allentown Water Works."

JAMES EMERY BROOKS.

"Design of a Constant-potential Dynamo."

ARTHUR STEBBINS CLIFT.

"Modern Practice in the Use of Single and Multiple Screw Propellers."

MORRIS LLEWELLYN COOKE.

"Effect of Clearance Surface on Cylinder Condensation."

HOWARD STEPHEN DECH.

"Circulation of Water in Steam Boilers, and its Effect on their Efficiency."

BEEKMAN DUBARRY, JR.

"Can Existing Tachometers exactly record Instantaneous Velocities?"

WALTER FERRIS.

"Design of a Sixty-kilo-watt Direct-current Four-pole Generator, Compound-wound."

EDUARDO ANTONIO GIBERGA.

"Determination of the Shaking Forces of an Engine, and its Best Speed."

ROBERT A. MCKEE.

"Tests of a (Harrisburg Ideal) Governor, and Reduction of its Forces and Masses.

JOHN SAMUEL MILLER.

"Design, Construction, and Test of a Webb Floating Dynamometer."

ARCHIBALD D. MILLER.

"Lubrication."

JOHN LIVINGSTON POULTNEY.

"Graphical Analysis of Stresses in a Steam Shovel."

SAMUEL NEELY RITER.

FOR THE DEGREE OF B.S.

(IN METALLURGY.)

"Modern Armor-plating."

JOHN THOMAS CALLAGHAN, JR.

"The Manufacture of Open-hearth Steel at the Works of the Bethlehem Iron Company."

WILLIAM WHEELER COLEMAN.

"The Refining of Lead and the Electrolytic Refining of Silver, as conducted by the Pennsylvania Lead Company."

HOWARD ECKFELDT.

"The Converse Process for the Separation of Franklinite from Willemite and Zincite, as conducted by the Lehigh Zinc and Iron Company."

GUY HECTOR FARMAN and
ROBERT MELVIN TARLETON.

"Investigation of the Working of Blast Furnace No. 6 of the Bethlehem Iron Company."

JOSEPH PHILIPS, JR.

"The Magnetic Concentration of Iron Ore."

WILLARD RANDOLPH VAN LIEW.

(IN MINING.)

"The Contamination of In-take Mine-air by Fire-damp in its Relation to Ventilation."

FRANKLIN BAKER, JR., and
WILLIAM AGASSIZ JAMES.

"The Utilization of Culm."

WILLIAM HENRY BROWN.

"The Tail-rope System of Underground Haulage at Maltby Colliery, Lehigh Valley Coal Company."

ARTHUR HUGHES LEWIS.

"The Monte Aguacate Gold Mines in Costa Rica, Central America."

CARLOS YGLESIAS Y CASTRO.

FOR THE DEGREE OF E.E.

"A Design for a Complete Railway System for South Williamsport, Pa."

CHESTER TERRILL AYRES.

"Triphase Alternating Currents of Electricity."

ERNEST MAR BLEHL.

"Three-phase Electric Power Plant for Washington, D. C."

EUGENE CLARE BROWN.

"The Supply of Power by Electricity for the New York City Underground Rapid Transit Railroad."

ROBERT EDES CHETWOOD, JR., and
JOHN JAMESON GIBSON.

"Incandescent Arc Lamps."

HENRY DE HUFF and
CHAUNCEY MATLOCK.

"Design of an Electric Light and Power Plant, and Study of the Plant at Easton, Pa."

STANLEY CHIPMAN DE WITT.

"Power Consumed by an Electric Car."

GEORGE LANE GABRIO and
THOMAS GRAHAM HAMILTON.

"Efficiency Test of a Westinghouse Transformer."

ROBERT RIEMAN HARVEY and
WILLIAM JACOB HISS, JR.

"Design of a Scott Phase-Converting Transformer."

WILLIAM HOPKINS.

"Wiring of University Buildings."

DREW WILLIAM IRVINE.

"Design of a 15 H.P. Three-phase Induction Motor."

ADOLPH SOMERS KAPPELLA.

"The Telephone System of Bethlehem."
DAVID HENSHEY LACKEY.

"Estimate of Line Construction."
LOUIS EDGAR LANNAN.

"Design for Underground Mail Transmission."
THEODORE PHILIP LOVERING.

"An Investigation of a Thomson-Houston Arc-Lighting Dynamo."
WILLIAM SPENCER MURRAY and
JOHN CRUM WHITMOYER.

"General Investigation and Efficiencies of an Electric Motor."
HENRY CRIDER QUIGLEY.

"Review of Arc Lamps."
EUGENE SCHWINGHAMMER.

"Transformation of Direct Currents."
EDWIN HARRISON SIGISON.

"Brush Arc-Lighting Apparatus."
JOHN BLAKE SLACK and
WILLIAM WARR.

"Test of a 500-Watt Transformer."
EDWARD GEORGE STEINMETZ and
HARRY AMASA WHITE.

"Design of a Power Station."
JOSEPH BOYER TOWNSEND.

FOR THE DEGREE OF A.C.

"Fire-clays and their Manufacture."
ELMER GRANT GODSHALK.

"The Conservation of the Volatile Products in the Coking of Bituminous Coal in Bee-hive Ovens."
CHARLES BORROWS JACOBS.

"Cements."
GERALD LEWIS.

"The Discoloration upon Brick and Building Material."
BENJAMIN W. LOEB.

"Purification of Commercial Aluminum."
JOHN EGBERT SHERO.

"Nickel-Plating."
NATHANIEL THURLOW.

"The Formation of Emulsions by Soaps and Alkalies as applied to the Scouring of Fabrics."
EDWARD NEWTON WIGFALL.

"Researches in the Lapachol Group; on the Reduction and Oxidation of Lapachol."
HAROLD LAWDEN WOOD.

FOR THE DEGREE OF B.S.

(IN ARCHITECTURE.)

"Specifications, Plans, and Details for a Residence."
HENRY EDWARD KIP.

"Plans for Dormitory Buildings for the Lehigh University."
WILLIAM REINECKE, JR.

"Design for a Railroad Station for South Bethlehem, Pa."
CHARLES FREDERICK TOWNSEND.

UNIVERSITY DAY.

This day is the last of the academic year, and falls in 1896 on the third Wednesday in June. On this day orations are delivered by members of the graduating class, and degrees are conferred.

EXERCISES ON JUNE 19, 1895.

Reading of Scripture and Prayer by the Rev. Taliaferro F. Caskey, Acting Chaplain of the University.

Salutatory Oration.—"The Inspiration of Life."
WARREN BYRON KEIM.

Oration.—"The College Man in Politics."
FAYETTE AVERY MCKENZIE.

Oration.—"Unsung Heroes."
JOHN EUGENE STOCKER.

Oration.—"Social Evolution."
WILLIAM ALLEN LAMBERT.

Oration—"The Marriage of Venice and the Sea."
ELMER AUGUSTUS JACOBY.

Valedictory Oration.
WALTER FERRIS.

Award of the Wilbur Scholarship to
WALTER EVERETTE BROWN,
of Stamford, Conn., first in rank in the Sophomore Class.

The Wilbur Prizes were awarded as follows:

Freshman Class, Mathematics, to
HARRY STATTEN ZIMMERMAN, of State Line.
WILLIAM ADAM DEHM, of New Britain, Conn.

Freshman Class, French, to
PERCY LAWRENCE REED, of New Bedford, Mass.

Freshman Class, German, to
HAROLD JOHN HORN, of South Bethlehem.

Freshman Class, Themes, to
WILLIAM GRATZ, of Carmel, N. J.

Freshman Class, Rhetoric, to
LEWIS CHESTON STARKEY, of Bustleton.

Freshman Class, Freehand Drawing, to
HOWARD CHARLES PADDOCK, of East Berlin, Conn.

Freshman Class, General Chemistry, to
HENRY THEODORE BORHEK, of Bethlehem.

The following Degrees were conferred by Professor William H. Chandler, Ph.D., Acting President of the University:

E. M.

WILLIAM A. ALLGAIER, B.S.,
JOHN YOUNG BASSELL, JR., B.S.,
ROBERT B. BRINSMADE, B.S.

B. A.

HENRY MILTON SNYDER CRESSMAN,
EDWARD CALVIN FERRIDAY,
HOWARD SAMUEL HESS,
ELMER AUGUSTUS JACOBY,
WILLIAM ALLEN LAMBERT,
ROBERT S. SIEGEL.

B. S.

DIXON KAUTZ (L.S.),
FAYETTE AVERY MCKENZIE (SCI.),
JOHN EUGENE STOCKER (SCI.),
ROBERT SAYRE TAYLOR (SCI.).

C. E.

HERMAN LEON ARBENZ,
ANTHONY FRANCIS BANNON, JR.,
JOHN COLLINSON BARBER,
ROLLIN CALVERT BASTRESS,
GEORGE BEGGS, JR.,
JOHN HENRY BEST,
WILLIAM BOWIE, B.S.,
WALTER TURPIN BROWN,
JAMES HODGSON BUDD,
CHARLES CALVIN BURGESS,
FRANCIS LEE CASTLEMAN,
WILLIAM JOSEPH COLLIER,
HERBERT MAURICE CRAWFORD,
JAMES CHAMBERS DICK,
ALFRED WILLIAM ALEXANDER EDEN,
EDWARD L. FAISON, JR.,
ANDRES GARZA GALAN,
WALLACE RUSSELL GOSS,
FREDERICK TAYLOR HAINES,
THOMAS LLOYD HENRY,
IRA MILLER HIGBEE,
HENRY SCUDDER JAUDON,
ELISHA BARTON JOHN,

WARREN BYRON KEIM,
STUART TUTTLE McKENZIE,
NORMAN PEACH MASSEY,
CHARLES FRAZIER MAURICE,
ROBERT NEILSON, JR.,
JAMES HARRY PHILIPS,
EUGENE JESSE RIGHTS,
HERBERT TIMOTHY RIGHTS,
HARRY KENT SELTZER,
J. F. VAN BENTHEM VAN DEN BERGH,
CHARLES HENRY VANSANT,
FRED IRVING WHEELER,
JOHN MARION WILSON.

M. E.

CLARENCE KEMBLE BALDWIN,
ROBERT JOSIAH BARTHOLOMEW,
HARRY WILBER BEACH,
CHARLES SUMNER BRICKER,
JAMES EMERY BROOKS,
ARTHUR STEBBINS CLIFT,
MORRIS LLEWELLYN COOKE,
HOWARD STEPHEN DECH,
WALTER FERRIS,
EDUARDO ANTONIO GIBERGA,
ROBERT A. McKEE,
JOHN SAMUEL MILLER,
ARCHIBALD D. MORRIS,
JOHN LIVINGSTON POULTNEY,
SAMUEL NEELY RITER.

B. S.

(IN METALLURGY.)

JOHN THOMAS CALLAGHAN, JR.,
WILLIAM WHEELER COLEMAN,
HOWARD ECKFELDT,
GUY HECTOR FARMAN,
JOSEPH PHILIPS, JR.,

ROBERT MELVIN TARLETON,
WILLARD RANDOLPH VAN LIEW.

B. S.

(IN MINING.)

FRANKLIN BAKER, JR.,
WILLIAM HENRY BROWN,
WILLIAM AGASSIZ JAMES,
ARTHUR HUGHES LEWIS,
CARLOS YGLESIAS.

E.F.

CHESTER TERRILL AYRES,
ERNEST MAR BLEHL,
EUGENE CLARE BROWN,
ROBERT EDES CHETWOOD, JR.,
HENRY DE HUFF,
STANLEY CHIPMAN DE WITT,
GEORGE LANE GABRIO,
JOHN JAMESON GIBSON,
THOMAS GRAHAM HAMILTON,
ROBERT RIEMAN HARVEY,
WILLIAM JACOB HISS, JR.,
WILLIAM HOPKINS,
DREW WILLIAM IRVINE,
ADOLPH SOMERS KAPPELLA,
DAVID HENSHEY LACKEY,
LOUIS EDGAR LANNAN,
PHILIP THEODORE LOVERING,
WILLIAM SPENCER MURRAY,
HENRY CRIDER QUIGLEY,
EUGENE SCHWINGHAMMER,
EDWIN HARRISON SIGISON,
JOHN BLAKE SLACK,
EDWARD GEORGE STEINMETZ,
JOSEPH BOYER TOWNSEND,
WILLIAM WARR,
HARRY AMASA WHITE,
JOHN CRUM WHITMOYER.

A.C.

ELMER GRANT GODSHALK,
CHARLES BORROWS JACOBS,
GERALD LEWIS,
BENJAMIN W. LOEB,
JOHN EGBERT SHERO,
NATHANIEL THURLOW,
EDWARD NEWTON WIGFALL,
HAROLD LAWDEN WOOD.

B. S.
(IN ARCHITECTURE.)

HENRY EDWARD KIP,
WILLIAM REINECKE, JR.,
CHARLES FREDERICK TOWNSEND.

At the close of the exercises of University Day, June 19, 1895, THOMAS MESSINGER DROWN, LL.D., was installed as President of the University, the ceremony being conducted by the Right Reverend Nelson Somerville Rulison, D.D., Bishop of Central Pennsylvania, President of the Board of Trustees.

THE WILBUR SCHOLARSHIP.

This Scholarship was founded in 1872 by E. P. Wilbur, Esq., of South Bethlehem, and is the sum of $200 awarded annually to the student in the Sophomore Class having the best record.

THE ALUMNI SCHOLARSHIP.

The Alumni Association of the University has established a Scholarship of the value of $250 per annum, subject to the following conditions:

1. That the Scholarship shall only be awarded to a student in need of it.

2. That the Scholarship shall not apply to the first year of any students' course; he must without this aid have gone through one year, and must be prepared to start the second year free from all conditions.

3. That the Scholarship shall not be continued to a student who shall at any time during his course carry any condition over eight weeks beyond the date of the examination in which he failed.

Subject only to the above conditions the disposal of the fund shall until otherwise directed be in the hands of the President of the University.

THE HENRY S. HAINES MEMORIAL SCHOLARSHIP.

Mrs. Henry S. Haines, of Savannah, Ga., has established a scholarship of the annual value of $200, which is to be devoted to the support at the Lehigh University, throughout his scholastic career, of one student in the School of Mechanical Engineering; the selection to be made by Mrs. Haines herself during her life-time.

WILBUR PRIZES.

By the generosity of E. P. Wilbur, Esq., a fund has been established, yielding an annual income of $100, for distribution in prizes as the Faculty shall determine.

ALUMNI PRIZES FOR ORATORY.

The "Alumni Association of the Lehigh University" has established an annual sum of Fifty Dollars, to be distributed in prizes for excellence in Oratory, subject to the following

REGULATIONS.

1. The Contest shall be held on the 22d day of February, or on the day designated by the University to commemorate the birthday of Washington.

2. There shall be a first prize of $25, a second of $15, and a third of $10.

3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.

4. Subjects for the oration shall be announced at the beginning of the first term of every year, and upon one of these each competitor shall write an oration not to exceed 1200 words, taking about eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do —should they be sufficient in number—the best six shall be chosen, and their envelopes opened. The others shall be returned to the address given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors whose orations shall have been approved, and the awards shall be made by a majority of these judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

At the last contest on February 22, 1895, the competitors were as follows:

Frederic Allyn Daboll, of Plainfield, N. J.
Lewis Benjamin Davenport, of Baltimore, Md.
Henry Neff Herr, of Wheatland Mills.
Robert Edward Laramy, of Bethlehem.
Homer Austin Reid, of Warren, O.
Joseph Wharton Thurston, of South Bethlehem.

The First Prize was awarded to Henry Neff Herr; the Second, to Frederic Allyn Daboll; the Third, to Homer Austin Reid.

The next contest will take place February 22, 1896.

ENTRANCE EXAMINATION PAPERS.

Used for Examination in 1895.

I.—ENGLISH.

I. Grammar.

1. Give the two different methods of comparing the adjective, with examples.

2. Define the *subject* and the *predicate*.

3. How many different ways are there of conjugating the verb? Illustrate by examples.

4. Give the relative pronouns and show how each is used.

5. Analyze the following sentence: It was, indeed, an unexampled circumstance, that a small squadron should be sent to the station which had been long occupied by a large fleet, commanded by the darling of the navy, and the glory of the British empire, to the station where this fleet had for years been wearing away in the most barren, repulsive, and spirit-trying service, in which the navy can be employed! and that this minor squadron should be sent independently of, and without any communication with the commander of the former fleet, for the express and solitary purpose of stepping between it and the Spanish prizes, and as soon as this short and pleasant service was performed, of bringing home the unshared booty with all possible caution and despatch.

II. Elementary Rhetoric.

1. What are the rules for the use of the semi-colon, the colon and the dash?

2. Explain what synonyms are, with examples; and show the relation of the words which compose such a group to each other.

3. What figures of speech are found in the following sentences?

(a) My love is like a red, red rose.

(b) Now is the winter of our discontent
Made glorious summer by this sun of York;

(c) O opportunity, thy guilt is great!
'Tis thou that executest the traitor's treason;

4. Write a composition of four hundred words upon one of the following subjects: The Career of Nicholas Nickelby; Thoughts in a Country Church Yard; The Plot of Kenilworth.

This composition is valued at forty per cent. of this portion of the paper.

II.—GEOGRAPHY.

Outline maps of the Central part of the United States, and of Northern Asia, were furnished to each applicant, and he was required to draw the boundaries of countries, provinces, states, and territories, and name them, to place and name the capital or chief city of each, and the principal rivers and mountain systems.

III.—UNITED STATES HISTORY.

1. How and by whom was the State of Delaware founded?
2. What can you tell about the campaign in the South in 1779?
3. Principal events during Jefferson's administration. Had Jefferson one or two terms?
4. State the causes and the result of the war with Mexico. When was the peace made?
5. What can you tell about the campaign in Virginia in 1864?
6. What is the Bland Silver Bill, voted in 1878?

CONSTITUTION.

1. *a.* How are new States admitted to the Union?
   b. What restrictions upon the formation of new States?
2. What mention is made in the Constitution of freedom of speech, religion, and the press?

3. *a.* What disability was incurred by certain persons taking part in the Civil War against the United States?
   b. How may this disability be removed?
4. In the United States, who declares war and makes peace?

IV.—ARITHMETIC.

1. Define ratio, proportion, percentage, cube root, number, composite number, factor, prime factor.
   How do you divide a common fraction by a decimal fraction? Give rule for finding greatest common divisor of two or more decimal fractions.
   How many inches in a meter? Feet in a mile? Pounds in a kilogram? Cubic inches in a liter?
2. Find the sum of $\frac{4}{5}$, $\frac{22}{45}$, $\frac{49}{75}$, $\frac{16}{25}$, $\frac{1}{3}$, and their least common multiple.
3. A 90 day note for $300, bearing interest at 5%, was dated June 15, 1892. On July 1st, 1892, $100 was paid on it. July 11, 1892, its owner discounted it at bank at 4% discount. How much did the bank pay him?
4. $\left[\left\{.1230048 \times 3.2990085 \div .000081457\right\} - \frac{.000004545}{.000017}\right] = ?$
5. Two wagons are loaded as follows: the first wagon, which weighs one ton forty-five lbs. when empty, contains seven bushels five pecks of corn, and fifty bars of inch square steel, each seven feet three inches long. The second wagon, weighing, empty, 45 lbs. less than a metric ton, contains $4\frac{1}{4}$ hectoliters of corn and seven steel billets, each $\frac{5}{8}$ meter long and 27x31 cm. in cross section. Steel weighs 490 lbs. per cubic foot, and corn 70 lbs. 6 oz. per bushel. Which wagon, loaded, weighs the most, and how much in pounds? in kilograms?

V.—GEOMETRY.

1. If a figure is symmetrical with respect to two axes at right angles to each other, it is also symmetrical with respect to the intersection of these axes as a centre of symmetry.

2. Two incommensurable ratios are equal if their approximate numerical values are always equal when both are expressed within the same measure of precision however small.
3. A parallel to the base of a triangle divides the other two sides proportionally.
4. The bisector of the exterior angle of a triangle divides the opposite side externally into segments which are proportional to the adjacent sides, and conversely.
5. Compute π by the method of perimeters.
6. Find the locus of all points whose distances from two fixed points are in a given ratio.
7. The area of the regular inscribed dodecagon is equal to three times the square of the radius.
8. Of all isoperimetric plane figures the circle is the maximum, and conversely.
9. The plane which bisects a diedral angle is the locus of all points equally distant from the faces of the angle.
10. Define: (*a*) Geometrical solid, angle, hypothesis, postulate, limit, mean proportion.
    (*b*) What is meant by: "An angle at the centre is measured by its intercepted arc"? When is a line said to be divided in extreme and mean ratio? When harmonically? When are two figures equal? When equivalent?
    (*c*) Define: Numerical measure of magnitude, plane, polyedral angle, symmetrical polyedral angles. What is a "centre of similitude"?

VI.—ALGEBRA.

1. Define equation, radical, root of an equation, simultaneous equations, imaginary quantity. What is the meaning of a negative exponent? A fractional exponent?
   How do you free a fraction of negative and fractional exponent, when its terms are monomial? Binomial?

2. When can radicals be simplified, and how? How do you clear an equation of radicals? Of negative exponents? What is meant by verifying an equation? When is an equation said to be satisfied?

4. Find the greatest common divisor of the following: $x^4+13x^3+33x^2+31x+10$, $4x^3+39x^2+66x+31$.
Find the least common multiple of the following: x^4-256, x^2-5x+4, x^2+3x-4.

4. Expand to five terms by the binomial formula,—
$\sqrt{\sqrt{x}-2\sqrt{y}}$, $\dfrac{1}{\sqrt{1-x^2}}$

5. Solve and verify,—
$\dfrac{32}{x^2-4}+3-\dfrac{5x+4}{2-x}=\dfrac{22}{x-2}$; also $\dfrac{\sqrt{x^2+2}-\sqrt{6x}}{x+4}=\dfrac{2-x}{\sqrt{x^2+2}+\sqrt{6x}}$

6. Solve
$$x+y+z+w=3$$
$$x-y+z+2w=12$$
$$x+y-z-w=-7$$
$$x+2y+z+3w=6$$

7. Produce formula showing relation of parts in a geometrical progression.

8. Solve $x^3-6x^2+13x-10=0$: also, $x^3+5x^2+3x-9=0$.

9. Solve $xy=2x+y-2$, $y^2=x^2-5$ also, $xy=3x+y-6$, $x^2+xy=24$

10. Divide a into two such parts that the difference of their squares shall be b.
What number is that which, being divided by the product of its two digits, the quotient is 3; and if 18 be added to it, the digits will be reversed?

VII.—PHYSICS.

1. Define:

a. Absolute unit of force.
b. Simple pendulum.
c. Inertia.
d. Capacity of a condenser.
e. Induced currents.

f. Electrolysis.
g. Pitch of a sound.
h. Sympathetic vibrations.
i. Overtones.
j. Absolute zero.
k. Radiant heat.
l. Thermal unit.
m. Diffused light.
n. Critical angle.
o. Dispersion of light.

2. Describe the Atwood's machine and explain its use.
3. Describe the Plate Electric machine and explain its action.
4. Describe the telephone.
5. Explain the principle of a freezing mixture composed of ice and salt.
6. How long will it take a ball to roll down an inclined plane 1000 meters long and 50 meters high and what will be its final velocity?
7. What will 10 cu. cm. of lead (sp. gr. 11.35) weigh in turpentine, whose sp. gr. is .87 ?
8. How long must a current of .144 amperes flow through a resistance of 46.64 ohms to generate heat enough to warm 10 grams of water from 0° C. to 13.9° C. ?
   How many foot-pounds of work will be done by the current in the same time?
9. If a pure copper wire has a weight of one grain and a resistance of .2106 ohms per foot and a commercial copper wire has a resistanc of .547 ohms per 20 feet and its conductivity is 93.9 per cent. that of pure copper, what is its weight?
10. What will be the result if we mix one pound of steam at 120° C. and 7 pounds of ice at — 10° C. ? (sp. ht. of ice .505, sp. ht. of steam .4805).
11. What will be the volume of 1000 cu. cm. of gas at 100° C. under a pressure of 30 inches of mercury if the temperature be changed to 200° C. and the pressure to 35 inches of mercury?

12. How long does it take sound to travel one mile, if the temperature of the air is 50° C.?

VIII.—PHYSICAL GEOGRAPHY.

1. Name the motions of the earth, state proofs, and what they cause.
2. Give classification of lakes, with an example of each.
3. Give classification of winds, with a description of each class.
4. Describe the Gulf Stream.
5. What causes (*a*) hoar frost, (*b*) dew, (*c*) hail.
6. Describe the rainbow.
7. Name and locate chief minerals of the United States.
8. Give the characteristics and distribution of the Caucasian race.
9. Describe the electrical phenomena of the atmosphere.
10. What are deltas and where found in the United States?

IX.—LATIN.

I. Grammar.

1. Give the derivation and the literal meaning according to the derivation, of—*praestiterunt*, *insisterent*, *coacervatis*, *remitterent*, *nequicquam*, *ascendere*, *iniquissimum*.

2. Write out the imperative mood and perfect subjunctive of—*accidissent*, *jacentibus*, *subire*.

3. Decline—*rem*, *rubis*, *sepes*, *agminis*, *iter*, *sibi*, *quidquid*, and give their genders.

4. Give principal parts of—*adjuvabant*, *deferebat*, *incisis*, *perspici*, *enatis*, *deligant*, *secuti*, *intercedere*, *adoriri*, *pulsa*.

5. Write out future and future perfect of—*possunt*, *deferebant*, *effecerant*, *impedirent*.

6. Give the derivation and the literal meaning according to the derivation, of—*munimentum*, *impediretur*, *admissis*.

7. Decline, and give the genders of—*rebus*, *locum*, *complures*, *exercitus*, *nocti*, *sarcinis*.

8. Write out imperative mood of—*capio*, *fero*. Also the imperfect subjunctive of—*possum*, *volo*, *fio*.

9. Decline throughout—*quisquam*, *quisquis*, *alius*.

II. Cæsar.

Translate:

Cæsar, paucos dies in eorum finibus moratus, omnibus vicis aedificiisque incensis, frumentisque succisis, se in fines Ubiorum recipit; atque iis auxilium suum pollicitus, si ab Suevis premerentur, haec ab iis cognovit: 'Suevos posteaquam per exploratores pontem fieri comperissent, more suo concilio habito, nuntios in omnes partes dimisisse, uti de oppidis demigrarent, liberos, uxores, suaque omnia in silvis deponerent, atque omnes, liberos, qui arma ferre possent, unum in locum convenirent; hunc esse delectum medium fere regionum earum, quas Suevi obtinerent; hic Romanorum adventum exspectare, atque ibi decertare constituisse.'

Cæsar, *B. G. IV.*, 10.

III. Vergil.

Translate:

1. Ecce, manus juvenem interea post terga revinctum
   pastores magno ad regem clamore trahebant
   Dardanidae, qui se ignotum venientibus ultro,
   hoc ipsum ut strueret Trojamque aperiret Achivis,
   obtulerat, fidens animi atque in utrumque paratus.
   seu versare dolos, seu certae occumbere morti.

Aen. I. l. 57.

Write out lines 4 and 5, marking the feet and caesuras. In what part of the story does this passage occur? Decline *Dardanidae* and explain the formation of the word.

2. Postera cum primo stellas Oriente fugarat
   clara dies, socios in coetum litore ab omni
   advocat Aeneas, tumulique ex aggere fatur:
   Dardanidae magni, genus alto a sanguine divom,
   annuus exactis completur mensibus orbis,
   ex quo reliquias divinique ossa parentis
   condidimus terra maestasque sacravimus aras.

Aen. V. l. 42.

How does *fugo* differ from *fugio?* Give synopsis of *fatur* in 3d Pers. Sing. Explain form *divom.*

Translate:

Vix ea fatus eram; tremere ommia visa repente,
Liminaque lauresque dei, totusque moveri
Mons circum, et mugire adytis cortina reclusis.
Submissi petimus terram, et vox fertur ad aures:
"Dardanidæ duri, quae vos a stirpe parentum
"Prima tulit tellus, eadem vos ubere laeto
"Accipiet reduces. Antiquam exquirite matrem.
"Hic domus Aeneæ cunctis dominabitur oris,
"Et nati natorum, et qui nascentur ab illis."

Aen. III., 90-98.

IV.—Cicero.

Translate:

Nunc ego, patres conscripti, mea video quid intersit. Si eritis secuti sententiam C. Cæsaris, quoniam hanc is in re publica viam, quae popularis habetur, secutus est, fortasse minus erunt, hoc auctore et cognitore hujusce sententiae, mihi populares impetus pertimescendi: sin illam alteram, nescio an amplius mihi negotii contrahatur. Sed tamen meorum periculorum rationes utilitas rei publicae vincat. Habemus enim a Cæsare, sicut ipsius dignitas et majorum ejus amplitudo postulabat, sententiam tamquam obsidem perpetuae in rem publicam volbntatis. Intellectum est, quid interesset inter levitatem contionatorum et animum vere popularem, saluti populi consulentem.—*Cat. IV., 5.*

V.—Sight Reading.

Translate (Cæsar, *B. G., VI., 35*):

Haec in omnibus Eburonum partibus gerebantur, diesque appetebat septimus, quem ad diem Cæsar ad impedimenta legionemque reverti constituerat. Hic quantum in bello fortuna possit, et quantos adferat casus, cognosci potuit. Dissipatis ac perterritis hostibus, ut demonstravimus, manus erat nulla quae parvam modo causam timoris afferret. Trans Rhenum ad Germanos pervenit fama, diripi Eburones atque ultro omnes ad praedam evocari. Cogunt equitum duo milia Sugambri, qui sunt proximi

Rheno, a quibus receptos ex fuga Tencteros atque Usipetes supra docuimus.

Translate (Cicero's *Epist.*):

Miseriae nostrae potius velim quam inconstantiae tribuas, quod a Vibone, quo te arcessebamus, subito discessimus: allata est enim nobis rogatio de pernicie mea, in qua, quod correctum esse audieramus, erat ejus modi, ut mihi ultra quadringenta milia liceret esse. Illo cum pervenire non liceret, statim iter Brundisium versus contuli ante diem rogationis, ne et Sicca, apud quem eram, periret et quod Melitae esse non licebat. Nunc tu propera, ut nos consequare, si modo recipiemur. Adhuc invitamur benigne, sed quod superest timemus. Me, mi Pomponi, valde paenitet vivere; qua in re apud me tu plurimum valuisti. Sed haec coram. Fac modo ut venias.

VI.—Composition.

Write in Latin:

Epaminondas, the Theban, when his soldiers were saddened (abl. abs.) because the wind had carried away (perf. pass. part.) from his speár an ornament hanging after the manner (*mōre*) of a fillet, [and] driven [it] upon the tomb of a certain Lacedæmonian, said: "Do not be alarmed, soldiers; destruction is portended to the Lacedæmonians; for (their) tombs are adorned with offerings."

VII.—History.

1. Describe the acts and characters of the first three Kings.
2. Tell the story of Coriolanus.
3. Describe the conquest of the Gauls in northern Italy.
4. Describe the invasion of Italy by Hannibal.
5. Describe the city and empire of Rome under Augustus.

X.—GREEK.

I. Grammar.

1. *a.* Write correctly *τέτριβσθαι, τρέφσω, συνγενής, θέθηθι.*

b. Contract *τιμάεαι, δηλόῃς, τείχεα, ἀργυρέαν.*

c. Accent *ἀνθρωποι τινες εἰσιν σοφοι.*

2. Decline in the singular *χάρις, ἧπαρ, εἰς, μνᾶ, σοφός*; in the plural *παῖς, πᾶς, εὐγενής, τιμή, ἁπλοῦς.*

3. Give the genitive, singular and plural, of *ναῦς, γραῦς, νοῦς, βοῦς*; the dative, singular and plural, of *εἰδώς, κύων, γυνή, ἀνήρ*; the accusative, singular and plural, of *βασιλεύς, πόλις, ἐλπίς, μήτηρ.*

4. Compare *πολύς, μέγας, σώφρων, ἐχθρός.*

5. Translate, *six hundred, second, five times, where? how?*

6. Give the principal parts of *γίγνομαι, ἔρχομαι, δύναμαι, φαίνω.*

7. Inflect the indicative (perfect and pluperfect) of *οἶδα*; the optative of *εἰμί*; the present subjunctive active of *τιμάω*; the second aorist imperative of *ἵστημι.*

8. Give the synopsis of the aorist (three voices) of *τίθημι*; of the future of *μένω*; of the perfect middle of *λείπω.*

9. Give the first person singular of the future indicative active of *τίκτω, φέρω*; of the aorist indicative active of *πίπτω, τρέχω*; of the perfect indicative active of *πάσχω, φημί*; of the perfect indicative middle of *πείθω, ἀφικνέομαι.*

10. *ἕλοι, ἁλοίη, αἱρεθείη, αἱροίη, αἱρήσοι*: where is each of these forms made? Give the first person singular (*a*) of the same mood and tense; (*b*) of the same tense, indicative mood; (*c*) of the present indicative.

II. Xenophon.

1. *Translate:*

Ἄνδρες, ἐάν μοι πεισθῆτε, οὔτε κινδυνεύσαντες οὔτε πονήσαντες τῶν ἄλλων πλέον προτιμήσεσθε στρατιωτῶν ὑπὸ Κύρου. τί οὖν κελεύω ποιῆσαι; νῦν δεῖται Κῦρος ἐπεσθαι τοῖς Ἕλληνας ἐπὶ βασιλέα· ἐγὼ οὖν φημι ὑμᾶς χρῆναι διαβῆναι τὸν Εὐφράτην ποταμόν, πρὶν δῆλον εἶναι ὅ, τι οἱ ἄλλοι Ἕλληνες ἀποκρινοῦνται Κύρῳ. ἐὰν μὲν γὰρ ψηφίσωνται ἕπεσθαι, ὑμεῖς δόξετε αἴτιοι εἶναι ἄρξαντες τοῦ διαβαίνειν καὶ ὡς προθυμοτάτοις

οὗσιν ὑμῖν χάριν εἴσεται Κῦρος καὶ ἀποδώσει· ἐπίσταται δ' εἴ τις καὶ ἄλλος· ἐὰν δ' ἀποψηφίσωνται οἱ ἄλλοι, ἀπιμεν μὲν ἁπαντες τοὐμπαλιν, ὑμῖν δὲ ὡς μόνοις πειθομένοις πιστοτάτοις χρήσεται καὶ εἰς φρούρια καὶ εἰς λοχαγίας, καὶ ἄλλον οὐτινος ἂν δέησθε οἶδα ὅτι ὡς φίλοι τείξεσθε Κύρου. ἀκούσαντες ταῦτα ἐπείθοντο καὶ διεβησαν, πρὶν τοὺς ἄλλους ἀποκρίνασθαι. Κῦρος δ' ἐπεὶ ᾔσθετο διαβεβηκότας, ἡσθη τε καὶ τῷ στρατεύματι πέμψας Γλοῦν εἶπεν· Ἐγὼ μέν, ὦ ἄνδρες, ἤδη ὑμᾶς ἐπαινῶ· ὅπως δὲ καὶ ὑμεῖς ἐμὲ ἐπαινέσετε, ἐμοὶ μελήσει, ἢ μηκέτι με Κῦρον νομίζετε.

Explain the conditional sentence (line 5) ἐὰν ψηφίσωνται, δόξετε, and translate into Greek the following: "if they should vote, you would seem," "if they voted, you seemed," "if they had voted, you would have seemed."

Explain the construction of στρατιωτῶν (l. 2), οὐτινος (l. 10), Κύρου (l. 10), εἶναι (l. 4), διαβαίνειν (l. 6), πιστοτάτοις (l. 9).

2. *Translate:*

Ἐνταῦθα Τισσαφέρνης καὶ οἱ σὺν αὐτῷ κάειν ἐπεχείρησαν τὰς κώμας. καὶ τῶν Ἑλλήνων μάλα ἠθύμησάν τινες, ἐννοούμενοι μὴ τὰ ἐπιτήδεια, εἰ κάοιεν, οὐκ ἔχοιεν ὁπόθεν λαμβάνοιεν. καὶ οἱ μὲν ἀμφὶ Χειρίσοφον ἀπῆσαν ἐκ τῆς βοηθείας· ὁ δὲ Ξενοφῶν ἐπεὶ κατέβη, παρελαίνων τὰς τάξεις, ἡνίκα ἀπὸ τῆς βοηθείας ἀπήντησαν οἱ Ἕλληνες, ἔλεγεν· Ὁρᾶτε, ὦ ἄνδρες Ἕλληνες, ὑφιέντας τὴν χώραν ἤδη ἡμετέραν εἶναι; ἃ γάρ, ὅτε ἐσπένδοντο, διεπράττοντο, μὴ κάειν τὴν βασιλέως χώραν, νῦν αὐτοὶ κάουσιν ὡς ἀλλοτρίαν. ἀλλ' ἐάν που καταλίπωσί γε αὐτοῖς τὰ ἐπιτήδεια, ὀψονται καὶ ἡμᾶς ἐνταῦθα πορευομένους. ἀλλ', ὦ Χειρίσοφε, ἔφη, δοκεῖ μοι βοηθεῖν ἐπὶ τοὺς κάοντας ὡς ὑπὲρ τῆς ἡμετέρας. ὁ δὲ Χειρίσοφος εἶπεν· Οὐκουν ἐμοιγε δοκεῖ· ἀλλὰ καὶ ἡμεῖς, ἔφη, κάωμεν, καὶ οὕτω θᾶττον παύσονται.

Explain the construction of κάοιεν (l. 3), ἔχοιεν (l. 3), λαμβάνοιεν (l. 3), ὑφιέντας (l. 6), κάωμεν (l. 11).

What is the subject of δοκεῖ (l. 9)?

What is the derivation of τάξις, ἀθυμέω?

Give the interrogative, demonstrative, and indefinite adverbs corresponding to ὁπόθεν.

ἀπῆσαν (l. 3), κατέβη (l. 4): explain the difference of tense.

Give, from the two passages above, examples of as many of the classes of verbs as possible, with the present stem in each case.

3. *Translate, at sight:*

Καὶ ναὶ μὰ Δί', ἔφη ὁ Σωκράτης, Κῦρός γε, εἰ ἐβίωσεν, ἄριστος ἂν δοκεῖ ἀρχων γενέσθαι, καὶ τούτου τεκμήρια ἄλλα τε πολλὰ παρέσχηται καὶ ὁπόπε περὶ τῆς βασιλείας τῷ ἀδελφῷ ἐπορεύετο μαχούμενος, παρὰ μὲν Κύρου οὐδεὶς λέγεται αὐτομολῆσαι πρὸς βασιλέα, παρὰ δὲ βασιλέως πολλαὶ μυριάδες πρὸς Κῦρον. ἐγὼ δὲ καὶ τοῦτο ἡγοῦμαι μέγα τεκμήριον ἄρχοντος ἀρετῆς εἶναι, ᾧ ἂν ἑκόντες πείθωνται καὶ ἐν τοῖς δεινοῖς παραμένειν ἐθέλωσιν. ἐκείνῳ δὲ καὶ οἱ φίλοι ζῶντί τε συνεμάχοντο καὶ ἀποθανόντι συναπέθανον πάντες περὶ τὸν νεκρὸν μαχόμενοι πλὴν Ἀριαίου· Ἀριαῖος δ' ἔτυχεν ἐπὶ τῷ εὐωνύμῳ κέρατι τεταγμένος.

βιόω, live. τεκμήριον, proof. αὐτομολέω, desert.

III. Homer.

1. *Translate:*

οἱ δ' ὅτε δὴ λιμένος πολυβενθέος ἐντὸς ἵκοντο,
ἱστία μὲν στείλαντο, θέσαν δ' ἐν νηῒ μελαίνῃ,
ἱστὸν δ' ἱστοδόκῃ πέλασαν προτόνοισιν ὑφέντες
καρπαλίμως, τὴν δ' εἰς ὅρμον προέρεσσαν ἐρετμοῖς.
ἐκ δ' εὐνὰς ἔβαλον, κατὰ δὲ πρυμνήσι' ἔδησαν·
ἐκ δὲ καὶ αὐτοὶ βαῖνον ἐπὶ ῥηγμῖνι θαλάσσης,
ἐκ δ' ἑκατόμβην βῆσαν ἑκηβόλῳ Ἀπόλλωνι·
ἐκ δὲ Χρυσηΐς νηὸς βῆ ποντοπόροιο.
τὴν μὲν ἔπειτ' ἐπὶ βωμὸν ἄγων πολύμητις Ὀδυσσεὺς
πατρὶ φίλῳ ἐν χερσὶ τίθει, καί μιν προσέειπεν·
Ὦ Χρύση, πρό μ' ἔπεμψεν ἄναξ ἀνδρῶν Ἀγαμέμνων
παῖδά τε σοὶ ἀγέμεν, Φοίβῳ θ' ἱερὴν ἑκατόμβην
ῥέξαι ὑπὲρ Δαναῶν, ὄφρ' ἱλασόμεσθα ἄνακτα,
ὃς νῦν Ἀργείοισι πολύστονα κήδε' ἐφῆκεν.

Give the prose equivalents of στείλαντο (l. 2), θέσαν (l. 2), νηός (l. 8), μιν (l. 10), προσέειπεν (l. 10), ἀγέμεν (l. 12), ἱλασόμεσθα (l. 13).

Mark quantities, feet, and caesuras in lines 5–8.

2. *Translate:*

Τῶν δ', ὥστ' ὀρνίθων πετεηνῶν ἔθνεα πολλὰ,
χηνῶν ἢ γεράνων ἢ κύκνων δουλιχοδείρων,
Ἀσίῳ ἐν λειμῶνι, Καϋστρίου ἀμφὶ ῥέεθρα,
ἔνθα καὶ ἔνθα ποτῶνται ἀγαλλόμενα πτερύγεσσιν,

κλαγγηδὸν προκαθιζόντων, σμαραγεῖ δέ τε λειμών,
ὡς τῶν ἔθνεα πολλὰ νεῶν ἄπο καὶ κλισιάων
ἐς πεδίον προχέοντο Σκαμάνδριον· αὐτὰρ ὑπὸ χθὼν
σμερδαλέον κονάβιζε ποδῶν αὐτῶν τε καὶ ἵππων.
ἔσταν δ' ἐν λειμῶνι Σκαμανδρίῳ ἀνθεμόεντι
μυρίοι, ὅσσα τε φύλλα καὶ ἄνθεα γίγνεται ὥρῃ.

Give the prose equivalents of *ἔθνεα* (l. 1), *πτερύγεσσιν* (l. 4), *ἔσταν* (l. 9), *ὅσσα* (l. 10).

Explain the construction of *προκαθιζόντων* (l. 5), *ποδῶν* (l. 8).

IV. History.

1. Give a brief account of the Spartan constitution.
2. Give an outline of the two Persian wars, with dates.
3. Describe the reforms of Kleisthenes; of Perikles.
4. When and by whom was the Theban supremacy established and when did it come to an end?
5. When did the Athenian expedition to Sicily take place? Who were its leaders? What became of them and what were the results of the expedition?

STUDENTS.

Clas.—Classical.
L.S.—Latin-Scientific.
Sci.—Science and Letters.
A.C.—Analytical Chemistry.
C.E.—Civil Engineering.
E.M.—Mining Engineering.
M.E.—Mechanical Engineering.
E.E.—Electrical Engineering.
Arch.—Architecture.

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Thomas Holland Clagett,	E.M.,	Berryville, Va.
Thomas Micks Clinton,	E.E.,	Baltimore, Md.
Barton Olmsted Curtis,	C.E.,	Iowa City, Iowa.
Patrick Edward Dinan,	A.C.,	South Bethlehem.
Louis Diven,	E.E.,	Elmira, N. Y.
Clifford George Dunnells,	C.E.,	Pittsburg.
Stuart Rhett Elliott,	E.M.,	Beaufort, S. C.
Albert Andrew Finkh,	M.E.,	Yonkers, N. Y.
Ira D. Fulmer,	E.E.,	Richland Centre.

	Course.	Residence.
Francisco Martinez Gallardo,	M.E.,	Guadalajara, Mex.
Orrin Satterlee Good,	E.E.,	Lock Haven.
Ralph Scofield Griswold,	E.E.,	Madison, N. J.
John Lewis Gross,	M.E.,	Wilkes-Barre.
Hugh Ellmaker Hale,	C.E.,	Philipsburg.
William Thomas Hanly,	C.E.,	Philadelphia.
Erle Reiter Hannum,	E.E.,	Pottsville.
William Stephen Hiester,	E.E.,	Elmira, N.Y.
Ross Nathaniel Hood,	E.E.,	Duncannon.
Oliver Zell Howard,	M.E.,	Hagerstown, Md.
Henry Taylor Irwin,	M.E.,	Allegheny.
James Madison Jackson,	M.E.,	Parkersburg, W.Va.
Arthur Perkins Jenks,	E.E.,	Philadelphia.
Harry Sackett Johnson,	E.E.,	East Aurora, N.Y.
Duncan Kennedy, jr.,	E.E.,	Washington, D. C.
Lawrence Rust Lee,	M.E.,	Shepherdstown, W.Va
Charles Victor Livingston,	E.E.,	Kingston, N. Y.
Arthur Frost Loomis,	E.E.,	Oneida, N. Y.
Owen Gray MacKnight,	E.E.,	Plains.
Barry MacNutt,	E.E.,	Bethlehem.
William Adams Megraw,	M.E.,	Baltimore, Md.
Esteban Angel Mercenario,	C.E.,	Pueblo, Mex.
Thaddeus Merriman,	C.E.,	South Bethlehem.
Frank Douglass Mount,	C.E.,	Manasquan, N. J.
Carl Pivany Nachod,	E.E.,	Glenside.
Henry H. Newton,	M.E.,	Guadalajara, Mexico.
Robert Collyer Noerr,	C.E.,	Washington, D.C.
Harry Richards Peck,	M.E.,	Scranton.
John O'Reilly,	A.C.,	South Bethlehem.
James Harkins Pennington,	M.E.,	Philadelphia.
Morris Havens Putnam,	M.E.,	Tioga.
John Peake Reynolds, jr.,	M.E.,	Charleston, S.C.
Robert Porterfield Richardson,	A.C.,	Easton.
Samuel Stewart Riegel,	M.E.,	South Bethlehem.
Eugene Peronnean Roundey,	C.E.,	East Orange, N.J.
Woodford Royce,	M.E.,	Willimantic, Conn.
Auguste Leopold Saltzman,	M.E.,	Plainfield, N.J.

	Course.	Residence.
Charles Fred. Sanders,	C.E.,	Kutztown.
Charles Francis Scott,	E.E.,	New York City.
Henry Hamilton Seabrook,	E.E.,	Beaufort, S. C.
Samuel Palmer Senior,	C.E.,	Washington, D.C.
Arthur Harold Serrell,	E.E.,	Plainfield, N. J.
Frank Bradley Sheaffer,	C.E.,	New Bethlehem.
John Leefe Sheppard, jr.,	M.E.,	Charleston, S. C.
Edward Peter Shuman,	C.E.,	Allentown.
Jonathan Edward Slade,	C.E.,	Chicago, Ill.
Michael Thomas Stack,	C.E.,	Shenandoah.
Alvin Riegel Sterner,	E.E.,	Bethlehem.
Paul Beno Straub,	E.E.,	Pittsburg.
John Williams Thomas,	E.E.,	Hokendauqua.
Thomas Cedwyn Thomas,	E.M.,	Wilkes-Barre.
Columbus William Thorn,	C.E.,	Washington, D.C.
Wallace Treichler,	C.E.,	Elizabethtown.
Harry Carpenter Tschudy,	C.E.,	Smyrna, Del.
William Edward Underwood,	M.E.,	Lancaster.
Harrison Ricord VanDuyne,	E.E.,	Newark, N. J.
Charles Parker Wagoner,	C.E.,	Phœnixville.
Edward Hileman Waring,	M.E.,	Plainfield, N. J.
Gilbert Case White,	C.E.,	Richmond, Va.
Warren Worthington,	M.E.,	Rush Valley.
George Livingston Yates,	E.E.,	Carlisle.
Ambrose Everett Yohn,	M.E.,	Saxton.
Frank Steinmetz Young,	E.M.,	Plymouth Meeting.

SOPHOMORE CLASS.

	Course.	Residence.
Harry Leigh Adams,	C.E.,	Washington, D.C.
Llewellyn H. Allport,	C.E.,	Philipsburg.
Thomas Johns Anderson,	M.E.,	Cumberland, Md.
Alanson Quigley Bailey,	Clas.,	Paterson, N. J.
Junius Ballard,	E.E.,	South Bethlehem.
Alejandro Barrientos,	C.E.,	Santiago de Cuba.
Richard Charles Becerra, jr.,	A.C.,	Caracas, Venezuela.

	Course.	Residence.
Arthur Knode Birch,	E.E.,	Washington, D. C.
Henry David Bishop,	M.E.,	Bethlehem.
Henry Theodore Borhek,	E.M.,	Bethlehem.
Frank Austin Boyer,	E.M.,	Pine Grove.
Horatio Francis Brown,	M.E.,	Baltimore, Md.
Paul Bucher,	E.E.,	Lebanon.
David F. Castilla,	M.E.,	Coahuila, Mex.
Greenleaf Howe Chasmar,	E.E.,	Brooklyn, N. Y.
David Hope Childs,	E.M.,	Towanda.
Benjamin Cooper Corbett,	Arch.,	New York City.
Herbert Myron Daggett,	E.E.,	Elmira, N. Y.
George Davies,	M.E.,	Catasauqua.
William Adam Dehm,	C.E.,	New Britain, Conn.
John Jacob Eckfeldt,	M.E.,	Conshohocken.
Linden Erle Edgar,	M.E.,	Wilkes-Barre.
Edgar D. Edmonston,	E.E.,	Washington, D.C.
James Ralph Farwell,	C.E.,	Oswego, N. Y.
John Augustus Fisher,	E.M.,	Huntingdon.
Edgar Raymond Frisby,	C.E.,	Washington, D.C.
Willard Boyer Fuller,	M.E.,	Catasauqua.
Archibald S. Furtwangler,	E.M.,	Greensburg.
José Maria Garza Galán, jr.,	E.M.,	Saltillo, Mex.
Stuart John Gass,	E.E.,	Washington, D. C.
Robert Edward Lee George,	E.E.,	Ellicott City, Md.
William Gratz,	E.E.,	Carmel, N. J.
William Gummere,	A.C.,	South Bethlehem.
Frank Hammond Gunsolus,	C.E.,	Tipton, Iowa.
Oscar C. Hannum,	C.E.,	Philadelphia.
Wentworth Greene Hare,	M.E.,	Philadelphia.
John Dwight Hastings,	E.E.,	Christiana.
Raymond Hazel,	E.E.,	Cressona.
George Duncan Heisey,	E.M.,	Pittsburg.
Henry Bruner Hershey,	E.E.,	Columbia.
Herbert H. Hess,	E.E.,	Hellertown.
Edward Darling Hillman,	M.E.,	Wilkes-Barre.
Harold John Horn,	E.E.,	South Bethlehem.
Leonard Sherman Horner,	E.E.,	Marshall, Va.
Philip Hopkins Janney,	M.E.,	Darlington, Md

	Course.	Residence.
Spencer Jackson Johnson,	E.M.,	Chicago, Ill.
Edwin Herman Kiehl,	C.E.,	Lancaster.
Frank Norman Kneas,	C.E.,	Norristown.
Arthur Octavius Knight,	M.E.,	Washington, D.C.
Edward Steckel Knisely,	M.E.,	Bethlehem.
Basil George Kodjbanoff,	M.E.,	Monastir, Macedonia.
Lewis Daniel Kreidler,	A.C.,	Bath.
Lewis Harry Kunkle,	M.E.,	Greensburg.
Thomas H. Lawrence,	E.E.,	Danville.
George Craig Leidy,	E.E.,	Washington, D. C.
John Brown Lindsey, jr.,	C.E.,	Frankfort, Ky.
Clarence Albert Loomis,	C.E.,	Bethlehem.
Owen Francis Luckenbach,	M.E.,	Bethlehem.
Frederic Kennedy Lundy,	E.E.,	Williamsport.
GeorgeKennedyMcGunnegle,	A.C.,	Meadville.
Lee Holmes Marshall,	M.E.,	Pittsburg.
Sidney Burbank Merrill,	A.C.,	Cincinnati, O.
Charles Francis Moritz,	E.E.,	South Bethlehem.
Hugh Nevins,	C.E.,	Hokendauqua.
Charles G. Newton,	E.M.,	Guadalajara, Mex.
José Aristides de Obaldia,	C.E.,	Panama, Rep. Col.
Howard Charles Paddock,	C.E.,	East Berlin, Conn.
Frederick Allen Perley,	C.E.,	Williamsport.
Clarence Marion Pflueger,	A.C.,	Seidersville.
Carroll Winston Quarrier,	M.E.,	Charleston, W. Va.
Victor Clinton Records,	C.E.,	Laurel, Del.
Percy Lawrence Reed,	C.E.,	New Bedford, Mass.
Benjamin DeWitt Riegel,	M.E.,	Riegelsville, N. J.
D'Arcy Wentworth Roper,	M.E.,	Petersburg, Va.
Rafael Francisco Sanchez,	E.M.,	Gibara, Cuba.
Henry Cord Schwecke,	E.E.,	Charleston, S. C.
Henry Harger Scovil,	M.E.,	Copenhagen, N. Y.
Daniel Franklin B. Shepp,	C.E.,	Tamaqua.
Charles Shimer,	M.E.,	West Bethlehem.
Louis Soleliac, jr.,	E.E.,	Allentown.
Lewis Cheston Starkey,	M.E.,	Bustleton.
James Willis Stauffer,	Arch.,	South Bethlehem.
Martin Shaaff Stockett,	Clas.,	Pottsville.

	Course.	Residence.
Edmund Harrison Symington,	M.E.,	Baltimore, Md.
William Wharton Thurston,	E.M.,	South Bethlehem.
Richard Albert Turner,	C.E.,	Willimantic, Conn.
William F. Ulrich,	A.C.,	Bethlehem.
Charles Bartlett Warren,	M.E.,	Westfield, Mass.
Levi Watts, jr.,	E.E.,	Terre Hill.
Charles Edward Webster, jr.,	Clas.,	South Bethlehem.
David Sheibley Wert,	E.E.,	Carlisle.
Frederick Charles Wettlaufer,	A.C.,	New York City.
Howard Josephus Wiegner,	Arch.,	Bethlehem.
Theodore Benjamin Wood,	M.E.,	Chambersburg.
William Bell Wood,	M.E.,	Baltimore, Md.
Lawrence Wooden,	C.E.,	Hampstead, Md.
Samuel Augustus Yorks, jr.,	E.E.,	Danville.
Harry Statten Zimmerman,	C.E.,	State Line.

FRESHMAN CLASS.

	Course.	Residence.
G. Fred Allen,	C.E.,	Florida, N. Y.
George Kriebel Anders,	E.E.,	Lansdale.
William Ernst Arrison,	E.E.,	Philadelphia.
Leon Whetstone Bailey,	E.E.,	Delano.
Clarence Barnard,	C.E.,	Washington, D.C.
Maurice Clark Benedict,	M.E.,	Altoona.
James Raymond Boak,	C.E.,	Hughesville.
Frank E. Bradenbaugh,	M.E.,	Parkersburg, W.Va.
John Morgan Buckland,	Sci.,	Hokendauqua.
Mahlon Brown Buckman, jr.,	M.E.,	Philadelphia.
José Fernando Capriles,	C.E.,	Puerto Cabello, Vene-
Charles Ford Carman,	C.E.,	Cedarville, N.J. [zuela.
Richard Francis Cleary,	E.E.,	Mahanoy City.
Bernard Todd Converse,	M.E.,	Louisville, Ky.
John Peter Croll,	C.E.,	Trexlertown.
Rudolph Degener,	E.E.,	New York City.
Joseph Ellenbogen,	L.S.,	Allentown.
James Chickering England,	E.E.,	Washington, N. J.
John Erwin,	M.E.,	West Bethlehem.

	Course.	Residence.
George Cooper Fairchild,	C.E.,	Oswego, N. Y.
Robert Farnham, jr.,	C.E.,	Washington, D.C.
Herbert William Fitzgerald,	C.E.,	Columbia.
Theodore Frederic Forbes,	A.C.,	Fort McPherson, Ga.
Grier Foresman,	A.C.,	Williamsport.
José Gervasio Gandia,	C.E.,	Puerta di Tierra, Porto Rico.
J. Walter Gannon,	C.E.,	New Brighton, S. I.
James Henry Gledhill,	M.E.,	Riegelsville.
Eugene Gifford Grace,	E.E.,	Goshen, N. J.
John Wesley Grace, jr.,	E.E.,	Goshen, N. J.
Arthur Bradley Hanscom,	M.E.,	Philadelphia.
Richard Allan Harris,	E.E.,	East Northfield, Mass.
Ernest Warfel Haverstick,	E.E.,	Lancaster.
Paul Gerhard Ludiger Hilken,	M.E.,	Baltimore, Md.
James Cuthbert Holderness,	E.E.,	Cambridge, Mass.
George Augustus Horne,	A.C.,	Plainfield, N. J.
Roy Rhodes Hornor,	E.M.,	Parkersburg, W. Va.
George Reifsnyder Jackson,	C.E.,	Scranton.
Harry Reese James,	M.E.,	Braddock.
William Edward Johnston,	E.M.,	Latrobe.
Russell Kimball,	M.E.,	New York City.
Arthur Warner Klein,	M.E.,	Bethlehem.
Harry Edward Knight,	Sci.,	New York City.
Richard Skerrett Landron,	C.E.,	Puerta de Tierra, Porto Rico.
Newton Wambold Leidy,	E.E.,	W. Bethlehem.
Leroy Streeper Leopold,	M.E.,	Pottstown.
Joseph William Linton,	E.E.,	Baltimore, Md.
Garth Bainbridge Luten,	C.E.,	Cayce, Ky.
Harry Packer Lynn,	Arch.,	Freemansburg.
Charles Michael Masson,	M.E.,	Hammondsport, N. Y.
Charles Pease Matheson,	C.E.,	Middletown.
William Lathrop Meaker,	A.C.,	Bethlehem.
James Flanders Middledith,	M.E.,	Plainfield, N. J.
Robert Hopkins Moffitt, jr.,	E.M.,	Harrisburg.
J. Foster Morgan,	E.E.,	Harwood Mines.
Elmer Fellman Musselman,	M.E.,	Middletown.
Frank Jacob Myers,	C.E.,	Bethlehem.

	Course.	Residence.
Charles Frederic Napier, jr.,	C.E.,	Asbury Park, N. J.
Charles Souders Padget,	Arch.,	Bethlehem.
Henry Ralph Palmer,	M.E.,	West Chester.
John Read Pettit,	E.M.,	Philadelphia.
William Piez,	M.E.,	Philadelphia.
Louis Thomas Rainey,	E.E.,	Decatur, Ill.
James Burr Reddig,	M.E.,	Shippensburg.
Percy Lesley Reed,	C.E.,	Sunbury.
Victor Hugo Reid,	E.M.,	Brooklyn.
Samuel Worman Ricker,	A.C.,	Easton.
Howard Albert Riegel,	C.E.,	Bethlehem.
Gustavo Rovelo,	M.E.,	Comitan-Chiapas, Mex
Oliverio Sanchez,	C.E.,	Nuevitas, Cuba.
Abraham Shimer,	M.E.,	West Bethlehem.
Robert Sargent Shriver,	Arch.,	Cumberland, Md.
Antes Latrobe Snyder,	C.E.,	Blairsville.
William Harold Speirs,	E.E.,	Bethlehem.
Abram Peters Steckel,	E.E.,	Lykens.
Robert Witmer Sterrett,	E.E.,	Milroy.
Robert Maximilian Straub,	C.E.,	Pittsburg.
Laurens Van Benthem,	E.E.,	The Hague, Holland.
John Sage Viehe,	E.E.,	Los Angeles, Cal.
Theodore Cuyler Visscher,	C.E.,	Rome, N. Y.
Joseph D. Wentling,	C.E.,	Greensburg.
Harry Packer Wilbur,	E.E.,	South Bethlehem.
Harry Anderson Wilcox,	E.E.,	West Granby, Conn.
George Bassett Williams,	Arch.,	Washington, D. C.
George Herbert Wood,	M.E.,	Chambersburg.
Edward Abraham Yellis,	C.E.,	Weaversville.
Wright Youtsey,	E.M.,	Newport, Ky.

SPECIAL STUDENTS.

	Course.	Residence.
Frederick Hutton Getman,	A.C.,	Stamford, Conn.
William Lindley Pettit, jr.,	C.E.,	Fort Wayne, Ind.
Francis Betts Smith,	M.E.,	Hartford, Conn.
Brigham Smoot,	A.C.,	Provo City, Utah.
John Stewart, jr.,	E.M.,	Lonaconing, Md.
Harry Wellington Thatcher,	A.C.,	South Bethlehem.

SUMMARY OF STUDENTS BY STATES.

Vermont,	1
Massachusetts,	6
Rhode Island,	2
Connecticut,	11
New York,	34
New Jersey,	25
Pennsylvania,	219
Delaware,	2
Maryland,	24
District of Columbia,	20
Virginia,	6
West Virginia,	6
South Carolina,	5
Georgia,	2
Florida,	1
Mississippi,	2
Kentucky,	4
Tennessee,	2
Ohio,	4
Indiana,	3
Illinois,	6
Michigan,	1
Minnesota,	2
Iowa,	4
Utah,	1

California,	1
Mexico,	8
Cuba,	4
Jamaica,	1
Porto Rico,	2
Costa Rica,	1
Republic of Colombia,	1
Venezuela,	2
Holland,	1
Macedonia,	1
	415

SUMMARY OF STUDENTS BY CLASSES AND COURSES.

	Graduates.	Seniors.	Juniors.	Sophomores.	Freshmen.	Specials.	Totals.
Classical,	8	4	—	3	—	—	15
Latin-Scientific,	—	—	—	—	1	—	1
Science and Letters,	1	1	—	—	2	—	4
Civil Engineering,	4	31	22	22	25	1	105
Mechanical Eng.,	2	26	26	27	21	1	103
Mining Eng.,	8	11	6	11	6	1	43
Electrical Eng.,	2	26	29	24	22	—	103
Analytical Chem.,	3	5	5	8	5	—	26
Architecture,	1	4	—	3	4	3	15
Totals,	29	108	88	98	86	6	415

ALUMNI

OF THE

LEHIGH UNIVERSITY.

A

Charles Lambert Addison, M.E. '88, 1120 Havemeyer Building, New York City.

Warren Howard Allen, A.C. '85, Athens, Pa.

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Frank Fielding Amsden, B.S. '87, E.M. '89, Blast Furnace Superintendent, Missouri Furnace Co., South St. Louis, Mo.

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*Lehman Preston Ashmead, A.C. '70, M.D.

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B

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*Deceased.

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William Williams Blunt, E.E. '92, Westinghouse Electric and Manufacturing Co., Pittsburg, Pa.

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William Bowie, B.S. (Trinity), C.E. '95, Annapolis Junction, Md. Employed on U. S. Coast and Geodetic Survey.

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Charles Hudson Boynton, B.S. (Lat. Sci.) '89, Night Manager, The Associated Press, Washington, D.C.

William Bradford, C.E. '88, Engineer Citizens' Traction Co., 142 South Negley Ave., Pittsburg, Pa.

William Young Brady, B.S. (in Architecture) '92, Architect for Department of Public Safety, City of Pittsburg, 5510 Centre Avenue, Pittsburg, Pa.

Frederick Edgar Bray, C.E. '93, Industry, Pa.

Thomas Joseph Bray, jr., M.E. '94, Supt. and Mech. Engineer, McGill & Co., Engineers and Machinists, 27th and Smallman Sts., Pittsburg, Pa.

Richard Singmaster Breinig, B.S. '86, E.M. '89, Engineering Department, Colorado Iron Works, 33d and Wynkoop Streets. Residence: Gurney Hotel, Denver, Col.

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Of these, 1 has taken the degrees of B.A. and B.M.; 9 of B.A. and M.A.; 2 of B.S. and C.E.; 1 of B.S. and A.C.; 11 of B.M. and E.M.; 32 of B.S. and E.M.; 1 of B.M., E.M., and A.C.; 1 of B.S., E.M., and C.E.; 1 of C.E. and E.M.; 2 of A.C. and E.M.; 1 of A.C. and M.S.; 1 of A.C., M.S., and Ph.D. 752 graduates are still living.

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